THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXVI.—No. 24. Whole No. 1,410. | NEW YORK, MONDAY, JUNE 16, 1902. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligen discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—

Wrinkle Department, Pacific Coast Gas Association 873

EDITORIALS—

Briefly Told 873

Mr. A. C. Humphreys to Succeed the Late President Morton—Hempel's "Gas Analysis"—Notes.

Proceedings, Twenty-fifth Annual Meeting, Western Gas Association

Official Report—Revised by the Secretary—Continued from Page 846 874

First Day, May 21—*Electrolysis of Underground Metals, by Mr. J. M. Humiston—Discussion—*Wrinkle Department, Edited by Mr. W. E. Steinwedell.

Experiences in Incandescent Gas Lighting in the Antipodes 882

What Improvement Is Desired in Electric Meters? 884

Massachusetts Electrical Systems in 1901.—Finances, by Mr. A. D. Adams 884

Some Averages of Electric Light Costs and Charges 886

CORRESPONDENCE—

Mr. Frederic Egner Explains 887

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 887

A Chicago Ordinance—Sale of Control, Kings County Gas and Illuminating Company—The New Plant at Ionia, Mich., Completed—A Breezy Suggestion by an Indianapolis (Ind.) Councilman—Proposed Opposition for Kansas City, Mo.—Personal—Mr. T. H. Hintze Takes Charge at Lowell, Mass.—The Gas Rate, Hyde Park, Chicago—A Vote on Municipal Operation, Norwich, Conn.—Annual Meeting, Gas and Electric Company, Bergen County, N. J.—Sale of the Marlboro (Mass.) Company—Hints from Portland, Ore.—Something from Baltimore, Md.—Annual Meeting, Nanaimo, B. C.—Rounding Up, Cook County, Ills.—New Regulations Concerning Sale of Coal Lands, Canada—And Other Items.

The Market for Gas Securities 889

[OFFICIAL NOTICE.]

Wrinkle Department, Pacific Coast Gas Association.

OFFICE OF EDITOR, WRINKLE DEPARTMENT,
PACIFIC COAST GAS ASSOCIATION,
1050 J STREET, FRESNO, CAL., May 14, 1902.

To the Members of the Pacific Coast Gas Association: As the Ninth Annual Meeting of the Pacific Coast Gas Association is drawing near, it behooves me, as the Editor of your Wrinkle Department, to remind you that it is time you were sending in your contributions to this department.

Wrinkles mean any small or large device, original in idea if possible, or anything that is not generally known to the gas fraternity, and that will in any way alleviate the trials and troubles of the gas man and promote his welfare and happiness, will be acceptable as a Wrinkle. If you will send in a sketch, photo or drawing, with explanation, it will be fully appreciated at our meeting this summer, as it depends entirely on the contributions, and following discussion of the members, to make these meetings successful.

Now, please, do not be backward, but send in all the Wrinkles you can gather up at once, and before you forget it. You may sign your name or not; just as you like. You surely have around your works, office, or main and service system a lot of original ideas that would be a benefit to some other member who is working under the same conditions.

Kindly make your contributions to this department at once, so as to enable me to get them in order before the meeting. Expecting an early reply, I am, Yours truly, GEORGE S. COLQUHOUN.

BRIEFLY TOLD.

MR. A. C. HUMPHREYS TO SUCCEED THE LATE PRESIDENT MORTON.—At a meeting of the Board of Trustees of the Stevens Institute of Technology, Hoboken, N. J., held the afternoon of the 5th inst., it was formally voted to offer the Presidency of the Institute to Mr. Alexander C. Humphreys, in succession to the late President, Mr. Henry Morton. The vote was taken by the complete Board, save the absence of Mr. Andrew Carnegie; and the request that Mr. Humphreys should serve was unanimous. Mr. Humphreys has not accepted this great trust officially as yet, but there can be no doubt that in the end he will direct where he was taught. An understanding as to the closing of the business affairs of Messrs. Humphreys & Glasgow is all that remains to be done preparatory to his occupying the Presidential chair. We need not make mention of Mr. Humphreys personality here, for that is and has been known to the gas fraternity for many a year; so suffice it to say that the graduate of 1881 becomes the director in 1902, and with him he has the wish and hope that his success in his newest and greater field of duty will be fully up to the measure made by his predecessor, than whom no more cultured, kindly and successful teacher ever lived. Mr. Humphreys was chosen a life member of the Board of Trustees of Stevens Institute, in 1891, and has done much for the material welfare of that sterling tutoring place.

HEMPEL'S "GAS ANALYSIS."—We are indebted to the Macmillan Company, of New York, for a copy of their new edition of "Methods of Gas Analysis," by Dr. Walther Hempel, of Dresden. The book is

JUN 17 1902

not by any means a novelty to gas men, for its worth has been tried with success by many of them in past years; but the third German edition, the translator of which for the Macmillans was Prof. L. M. Dennis, of Ithaca, N. Y , has been sufficiently enlarged and revised to quite oblige us to consider that it is really a new book. Orders for it may be sent to us.

NOTES.—The Board of Trustees of Green Island, N. Y., have granted a franchise for the maintenance and operation of a gas works in that place to Messrs. Albert McCoubray and John E. Thompson, of Green Island, who represent the Pennsylvania Fuel Gas and Construction Company. Under the agreement the plant is to be in operation by Jan. 1st, 1905, and it is stipulated that gas supplied for public account and use is to be billed at the rate of 50 cents per 1,000 cubic feet, the charge for supply on ordinary account to be: For illuminating use, $1 per 1,000; for fuel use, 75 cents per 1,000.——The offices of the Syracuse Gas Company and of the Syracuse Lighting Company, Syracuse, N. Y., have been removed to the Dunfee Building, Nos. 110, 112 and 114 East Jefferson street. The change will be appreciated by the patrons and the office forces of both companies.——A correspondent forwards the following from Sacramento, Cal., under date of June 6th: "This week a curious crusade was started in the Board of City Trustees by Trustee Devine, who insisted on a hearing of his complaint against the Capital Gas Company, which he insisted was illegally discriminating against the residents by charging $1 per 1,000 cubic feet for gas in those sections of the city where it came in actual competition with the natural gas suppliers, while it was charging $1.75 in sections not reached by the natural gas mains. He claimed that this was in direct conflict with the 'organic' law of the city, and also urged that the Board of Trustees had the right to order the Company to maintain only a flat rate or equal rate in serving its patrons. Mr. L. T. Hatfield, representing the Capital Company, stated that the $1 rate was extended beyond the districts in which the Natural Gas Company was a competitor, but that the extension of that rate over the entire city was impracticable at present. A short time ago the Capital Gas Company had voluntarily reduced the rate from $2 to $1,75 per 1,000, and as soon as the increase in consumption justified the action another reduction would be made. He held that the city, under the Company's charter, had no right whatever to dictate what rate or rates it might charge, which statement could, in his belief, be readily determined by a proper action in law. He also thought it was in bad taste to keep harassing a Company that was expending more money in and giving more employment to people of the city than any other corporation save the Southern Pacific Railway Company. He averred that if the Board desired to treat his Company in fairness he was willing that a Committee of the Board, or for that matter the entire Board, should confer with the Company. In such event every facility would be granted the examiners for investigation, and he was certain they could easily be convinced that a uniform $1 rate for the city was not practicable. A motion to refer to the judiciary committee, with instructions to confer with the Corporation Counsel, was finally adopted, and so the matter stands."——Mr. Charles A. Stone has been elected President of the Brookline and Dorchester (Mass.) Gas Companies, and Mr. F. Tudor, Jr., has been elected President of the Jamaica Plain (Mass.) Gas Company. Mr. George H. Finn has been chosen Vice-President of the named Companies, succeeding the late Mr. Wm. L. Elkins, Jr. All these changes refer to pending reorganization of the New England Gas and Coke Company, the affairs of which are at least temporarily in control of Messrs. Kidder, Peabody & Company.——Messrs. F. R. Jackson, S. C. Jayne and J. J. Wentz are proposing the incorporation of a gas Company for Berwick, Pa. — Mr. S. A. Wheeler, of Buffalo, N. Y., President of the Natural Gas and Fuel Company, of Lancaster, Pa., has asked a franchise from the City Council of Tiffin, O., for the right to supply natural gas thereto and therein. The maximum selling rate is put at 50 cents per 1,000. ——Certain New York speculators have applied for the right to operate an opposition concern in Altoona, P. Its corporate cognomen is that of the Mountain City Gas Company.——The Spencer (Mass.) Gas Company has been acquired by the Boston Light, Heat and Power Company. Mr. A. M. Whitney of the purchasing Company, succeeds Mr. F. A. Drury as Treasurer of the Spencer concern. Mr. Clarke is to continue as Superintendent.——The East St. Louis (Ills.) Gas Company has changed hands. The new owners propose to expend $20,000 in plant betterment and main enlargement.——The annual meeting of the Pawtucket (R. I.) Gas Company resulted in the naming of the following Directors: Jno. Chace, L. M. Darling, D. L. Goff, S. A. Jenks, F. W. Easton, F. A. Sayles, A. M. Coats, J. A. Armstrong, S. R. Bertron, F. B. Bemis and R. S. Storrs.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.—Continued from Page 846.]

PROCEEDINGS, TWENTY-FIFTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.

HELD IN THE NEW ST. CHARLES HOTEL, NEW ORLEANS, LA., MAY 21, 22 AND 23, 1902.

FIRST DAY, MAY 21.

The President introduced Mr. J. M. Humiston, of Chicago, Ills., who read[1] the following paper on

ELECTROLYSIS OF UNDERGROUND METALS.

Mr. Edwin J. Houston, in his "Dictionary of Electrical Words, Terms and Phrases," defines electrolysis as "chemical decomposition effected by means of an electric current." The nomenclature of electrolysis was applied and the laws were enunciated by that frontiersman of electrical science, Michael Faraday.

The popular conception of the source of corrosion in electrolysis comprehends the combination of an atom of oxygen at the instant it is freed from a molecule of water with any metal which can be seized upon. The scientific theory, based upon the results of extended experiments in electro-chemistry, which I am not competent to discuss, is somewhat more complicated.

Prof. D. C. Jackson, of the University of Wisconsin, thus describes the action: "In an electrolytic cell with iron electrodes, having any salt or salts of alkaline metals or earths in solution in the electrolyte, the salts are decomposed, their acid radicals attacking the anode, forming an iron salt."

A striking proof of this theory is found in the storage battery, in charging which device a large current is discharged from a lead plate into an electrolyte, consisting of dilute sulphuric acid. In the storage battery the oxidation of both plates takes place, but the result is a red oxide very different in character and quantity from the corrosive effects of the current on a subterranean lead pipe.

Early in the summer of 1891, Mr. I. H. Farnham, of the New England Telephone Company, had his attention called to some lead covered cable removed from some wooden ducts in the city of Boston. At certain spots this cable was badly corroded and the injury was generally charged to the combination of creosote and acetic acid in the duct material. Mr. Farnham diagnosed the case differently, and in a report to his Company stated that the injury was due to stray railway currents. Some months later another cable resting on the ground in the bottom of an underground vault was found to be eaten entirely through at the point of contact with the earth.

He then proceeded to prove his theory. A metal plate was placed in the bottom of a barrel and connected to the negative terminal of a 4-volt storage battery. The barrel was then filled with dampened earth taken from an excavation in the street, and two pieces of lead cable placed in the earth; one of these was connected to the positive terminal of the storage battery. This combination was allowed to work for one week. At the end of that time it was examined and the piece of cable connected with the battery was found to be badly corroded, while the other piece of cable showed no sign of corrosion.

Subsequently, two pieces of cable were placed in the vault previously mentioned, one of which was connected to the cable that had been damaged by electrolysis, but which had since been repaired and raised from the ground. The other piece simply lay in the ground, care being taken that it did not touch the first cable. At the end of 6 weeks the two pieces were uncovered, with the anticipated result.

Measurements were then taken of the electrical potential of the cable to the earth and to the tracks at different points, the current flowing in the cable was examined, the effect of approaching cars was noted and all the characteristics of a street railway load were found to be present. These experiments resulted, I think, in the original discoveries of railway electrolysis. The current paths of a single trolley, street railway system consist of an insulated metallic wire for one side of the circuit, and for the other side a track of steel rails made metallically continuous by means of copper bonds, and perhaps reinforced by negative feeders.

This earthed conducting system is our point of interest, The load on a railway system is constantly varying both in quantity and location.

---

1. Before reading the paper Mr. Humiston remarked:

When one of the Directors of the Association first spoke to me about reading a paper here I had in mind meetings of other technical associations (slightly soporific in character), which I had attended, and readily consented. I confess that since I have been here this morning and listened to your wideawake discussions, I feel somewhat timid about appearing before you with my theories concerning electrolysis.

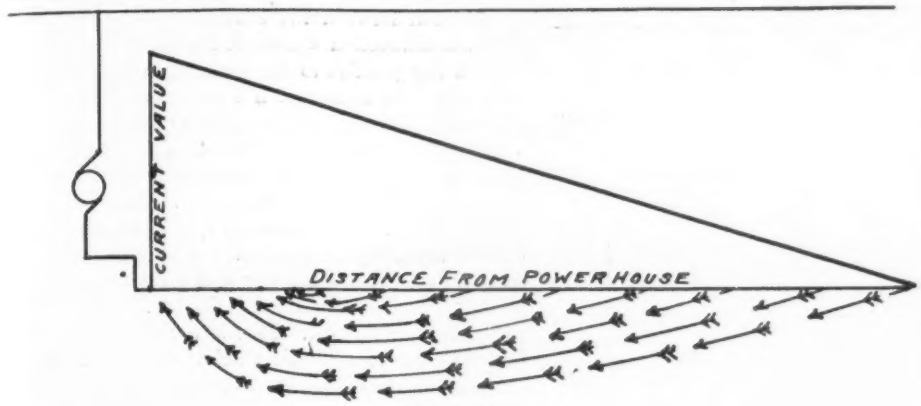


FIG 1.

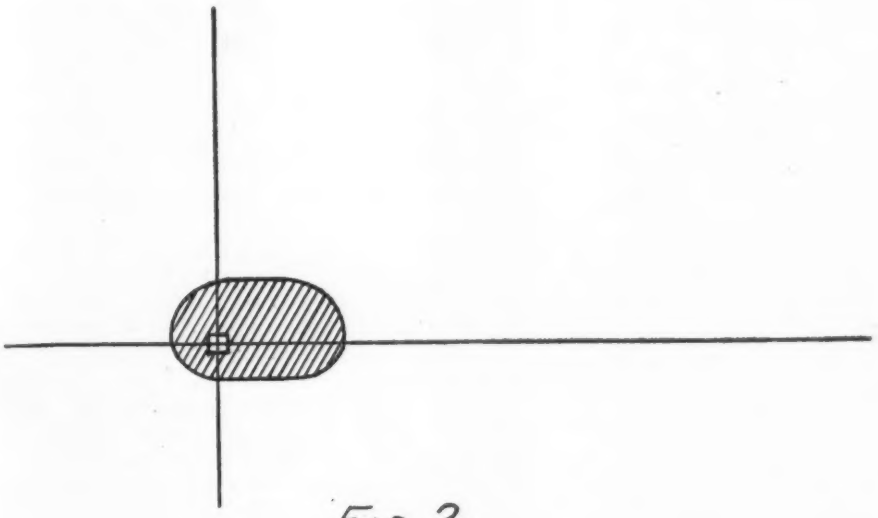


FIG 2.

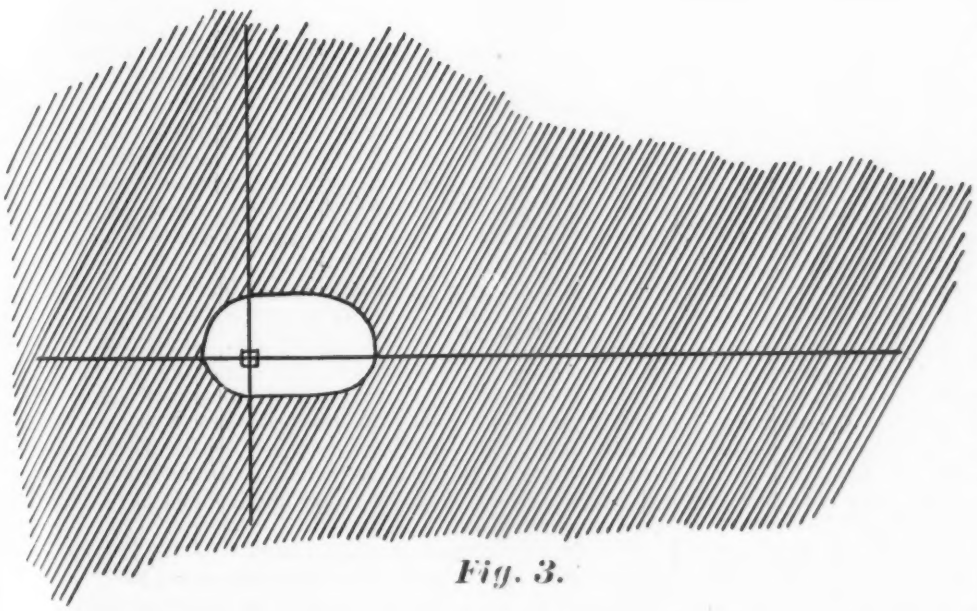


Fig. 3.

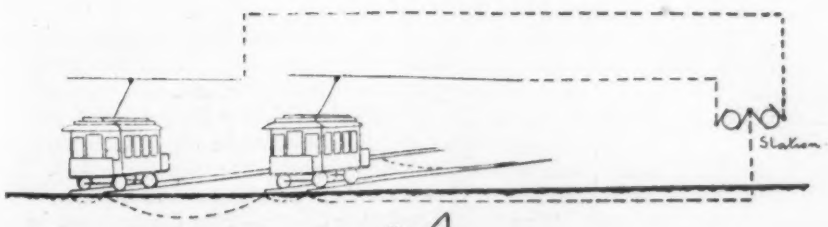


Fig. 4.

This fact makes the physical characteristics of the return circuit somewhat difficult to investigate.

If some means could be found to measure over a considerable period the current at every point in the track, it is probable that the average condition would be found to be approximately similar to that of a conductor carrying a current uniformly increasing in value from zero at the outer end to the average load at the power station.

Supposing the current to flow in the rails toward the power station. In the outer end of the track a portion of the current leaves the track to take the earth, and returns to the track near the power station.

Distribution of Parasitic Currents.—One point in the track, as shown in Fig. 1, is neutral. At this point no current is passing from rail to earth. Outside of this point the earth is negative to the rail, and toward the station from this point the earth is positive to the rail. In the diagram I have taken this point as one-fifth of the distance from the power station. This is the location in our imaginary case. The disposition of underground pipes might vitiate this assumption, which is true only for a return circuit of uniform conductivity.

Fig. 2 is a diagram of a railway system with the negative pole to earth.

The power station is at the intersection of two lines of railway. The shaded portion represents the area in which any underground pipes are positive to the earth. It is our danger district. For any underground pipe having a uniform electrical conductivity, it is our only danger district; pipes outside of this area could only suffer because of the current being obliged to leave them to get around a poorly conducting joint.

Fig. 3 is a diagram of the same system, with the positive pole to the track, the shaded portion again representing the danger area.

The difference is somewhat striking. Since Mr. Farnham's classic exposition of electrolysis in 1894 it has been the custom for street railways to operate with the negative pole to earth, thus restricting the danger area and simplifying the solution of some parts of the problem.

For the protection of any underground lead-covered cables it is only necessary to extend from the negative pole of the dynamo to certain points in the danger district, a copper conductor of sufficient size to render the sheaths of the cables negative to earth. Underground cables usually lay in ducts and do not make a circumferential contact with earth, and leakage to them is slight.

With iron pipes it is different. They have larger contact surface with earth and offer a path of varying resistance. A well made screw coupling on wrought iron pipe might offer a resistance equal to 50 feet of pipe, which, if the pipe were carrying a large current, would throw a portion around through the earth. Calked joints of both lead and cement, it is well known, offer considerable resistance, presenting the same phenomena.

This really scientific measure has other drawbacks. While entirely efficient for a single, metallically continuous underground tube, for a ramifying system it should be

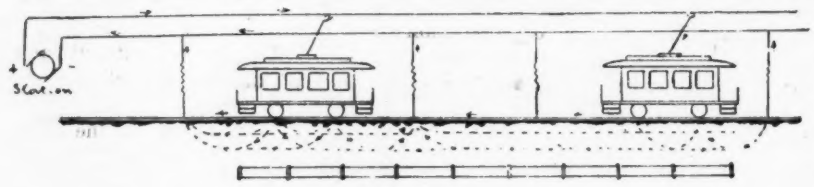


Fig. 5.

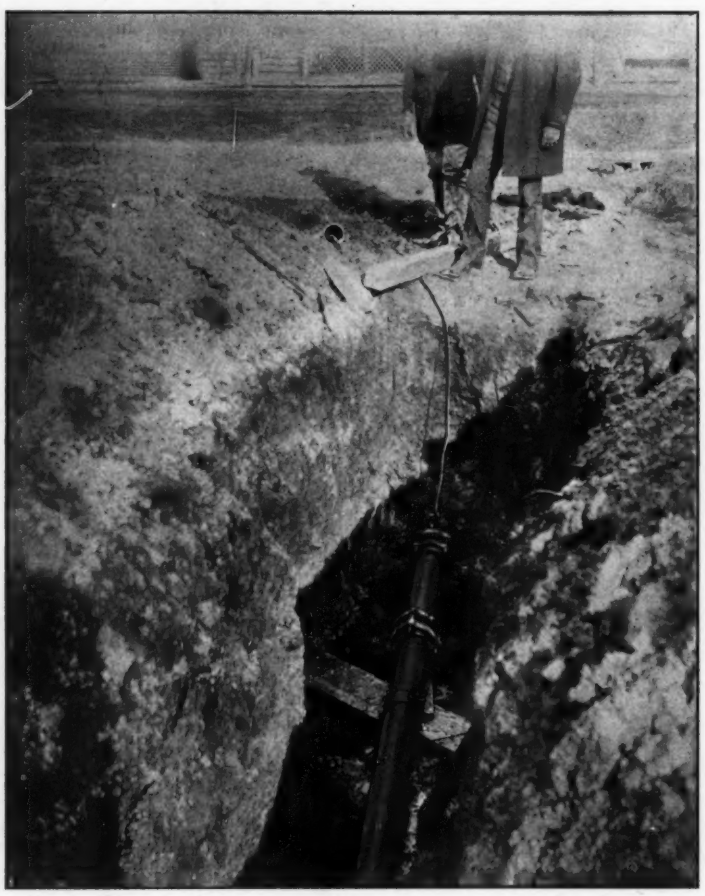


Fig. 6.

watched with considerable care to see that a balance is maintained. It is difficult to insure this, because the load points of an extensive railway system shift for different hours of the day. It is also evident that the installation of a return feed would lower the ground potential in the protected area, which means that electrolytic action on any other system of pipes in this district would be accelerated. It follows from this that the current flowing in the system it is desired to protect would be increased in volume, thus augmenting the shunting of current around calked joints. In addition to the return feed, which has most prominence as a palliative, a large number of other methods have been suggested, from which I have selected the following for consideration: The use of ground plates; the use of the 3-wire system; the use of insulated return feeders so designed as to secure the same conductivity between the negative of the dynamo and all points in the track; the use of boosters for balancing; the use of negative boosters inserted in the return circuit; the use of insulating joints.

The Ground Plate.—The object of the ground plate is to lessen the difference of potential between the protected metal and the earth. This can be done by making a good earth connection. I have installed two such ground plates. One was within the stock yards of Chicago, in a clay soil, the upper foot of which was almost a stratum of manure, and the other was in quicksand about a mile from the shore of Lake Michigan. They were at what was at that time two extremities of the conduit system of the Chicago Telephone Company. Each ground plate consisted of about 500 pounds of wrought iron plate buried in about 1,000 pounds of wrought iron turnings and punchings, the whole covering a space about 5 by 8 feet, and being 10 feet below the surface of the ground.

The cables which it was proposed to protect were connected to the ground plate with a 00 rubber covered, copper cable. The soldered joint on the plate was of course thoroughly covered with tar. Before making the connection to the plate in quicksand, there was a difference of potential between the cable and the ground of 2.2 volts; after the connection was made the difference was .4 volts, the cable being positive to the ground in both cases. These results were the means of a number of observations and represent with considerable accuracy the change of condition. The ground in the stock yards had a similar effect. The beneficial effect, however, of these two devices gradually decreased during a period of 2 years. At the end of that time extensions of the underground system were completed, and it became necessary to remove the connections to these grounds. At that time their efficiency was only about 25 per cent. of what it was at the time of installation.

The 3-Wire System.—This is the adaptation of the Edison 3-wire system to a double track trolley road. For the benefit of those present who do not operate electric lighting plants, I will explain that the 3-wire system is one using 2 dynamos for generating and 3 wires for transmitting, and which requires about $\frac{5}{8}$ of the copper in line necessary in a 2-wire system using the same amount of energy. The result of applying this to a street railway would be that the amount of current daily flowing in the grounded return circuit would be decreased from the total daily output of the station to the summation of the varying difference between the output of the two generators for one day. It is evident that this somewhat attractive method can only be used where a sufficient number of cars are operated to make it probable that the load on one side of the system would generally balance that on the other.

The City and South London Railway, of the British Metropolis, is the only instance I can cite now where this system is used, although I am quite certain there are others in this country. For such a system the danger area would be constantly changing, and any data obtained by a survey of the pipes would be almost useless.

The Use of Compensating Feeders.—If an insulated negative feed was run from every 300 feet of track to the power station, and these returns all possessed the same resistance, every 300 feet section would be of the same potential as all other sections, and there would only be a variation of potential along each 300 feet of track. Such a minute subdivision is impracticable, but on a large system it should be approached. Most of the city ordinances comprehending electrolytic action require that the variation in potential over a given length of track be kept below a certain value. Mr. Edward B. Ellicott, the City Electrician of Chicago, who has done much valuable work, goes a little further and advises that, in order to scatter the corrosive action, the variation of potential be uniform over this length of track. His recommendations have been embodied in an ordinance, passed by the City Council, providing that grounded return circuits should be so constructed that a greater difference of potential than 3½ volts should not exist at any point between the water pipes and the rails, and the variation between any 2 points within 300 feet should not exceed ½ volt.

The Use of Boosters for Balancing.—A booster is a device for regulating the electrical pressure on a transmission circuit It may be either a motor dynamo or a storage battery. A case may be imagined in which the underground pipe is 4 volts positive to the track. If now a 4-volt storage battery is placed with the negative terminal to the pipe and the positive terminal to the track, it will tend to pump the current into the track. Batteries have been occasionally used in Chicago to protect telephone cables where extensions to the underground plant were rapidly being made and a return feed would be too expensive for a temporary measure.

The Use of Negative Boosters Inserted in the Return Circuit.—Gisbert Kapp, a well-known German engineer, has lately proposed the division of the track into insulated sections, these sections to be connected through the secondaries of low voltage motor generators, the primaries being cut into the positive or line side of the circuit. The booster will then pump the current from one section of the rail into the next, thus assisting to keep the current out of the ground. The primary of the booster using line current insures a compensatory action for varying loads. Mr. Kapp had previously designed and put in operation a large system in Glasgow, Scotland, in which a great number of boosters were used as electricity pumps in the negative feeders. The same device has been used at a number of other places in Britain.

The Use of Insulating Joints.—This device must be used with extreme care, and any application of the principles should be gener-

of 2.2 volts;
as .4 volts, the
ses. These re-
ations and re-
of condition,
fect. The bene-
gradually de-
nd of that time
mpleted, and it
these grounds,
25 per cent. of

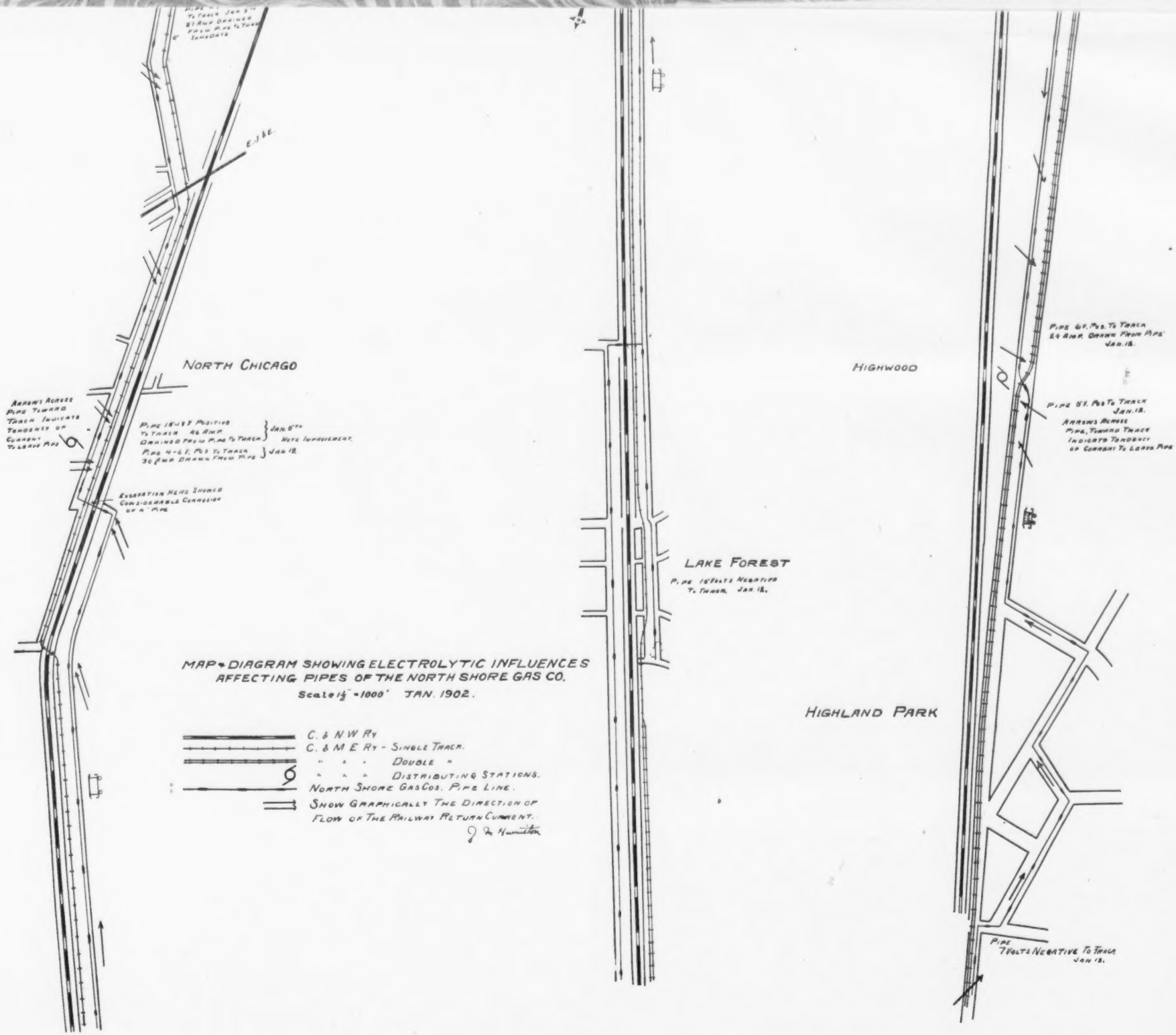
n of the Edison
For the benefit
ghting plants,
using 2 dynamos
, and which re-
sary in a 2-wire
The result of
at the amount of
n circuit would
he station to the
en the output of
nt that this some-
where a sufficient
able that the load
alance that on the

, of the British
now where this
there are others in
er area would be
ed by a survey of

n insulated nega-
track to the powe
he same resistance
he potential as a
riation of potenti
nute subdivision
uld be approached
electrolytic acti
r a given length
Edward B. Ellicot
done much valuab
order to scatter th
rm over this leng
ed in an ordinanc
nded return circu
of potential than
water pipes and t
n 300 feet should

is a device for re
circuit It may
ase may be imagi
to the track. If
e terminal to the p
d to pump the cur
y used in Chicag
e underground p
d be too expensive

The Return Circu
has lately proposed
ese sections to be
motor generators
ide of the circuit.
ction of the rail int
e ground. The prin
ensatory action for
and put in operat
great number of bo
feeders. The same
ritain.
must be used wit
ciples should be g


NORTH CHICAGO
HIGHWOOD
LAKE FOREST
HIGHLAND PARK
E. J. & E.
ARROWS ACROSS PIPE TOWARD TRACK INDICATE TENDENCY OF CURRENT TO LEAVE PIPE
EXCAVATION NEAR SHOULD CONSIDERABLE CORROSION OF 4" PIPE
PIPE 18 VOLTS NEGATIVE TO TRACK JAN. 18.
PIPE 6 V. POS. TO TRACK 2.4 AMP. DRAWN FROM PIPE JAN. 18.
PIPE 8 V. POS. TO TRACK JAN. 18.
ARROWS ACROSS PIPE, TOWARD TRACK INDICATE TENDENCY OF CURRENT TO LEAVE PIPE
PIPE 7 VOLTS NEGATIVE TO TRACK JAN. 18.

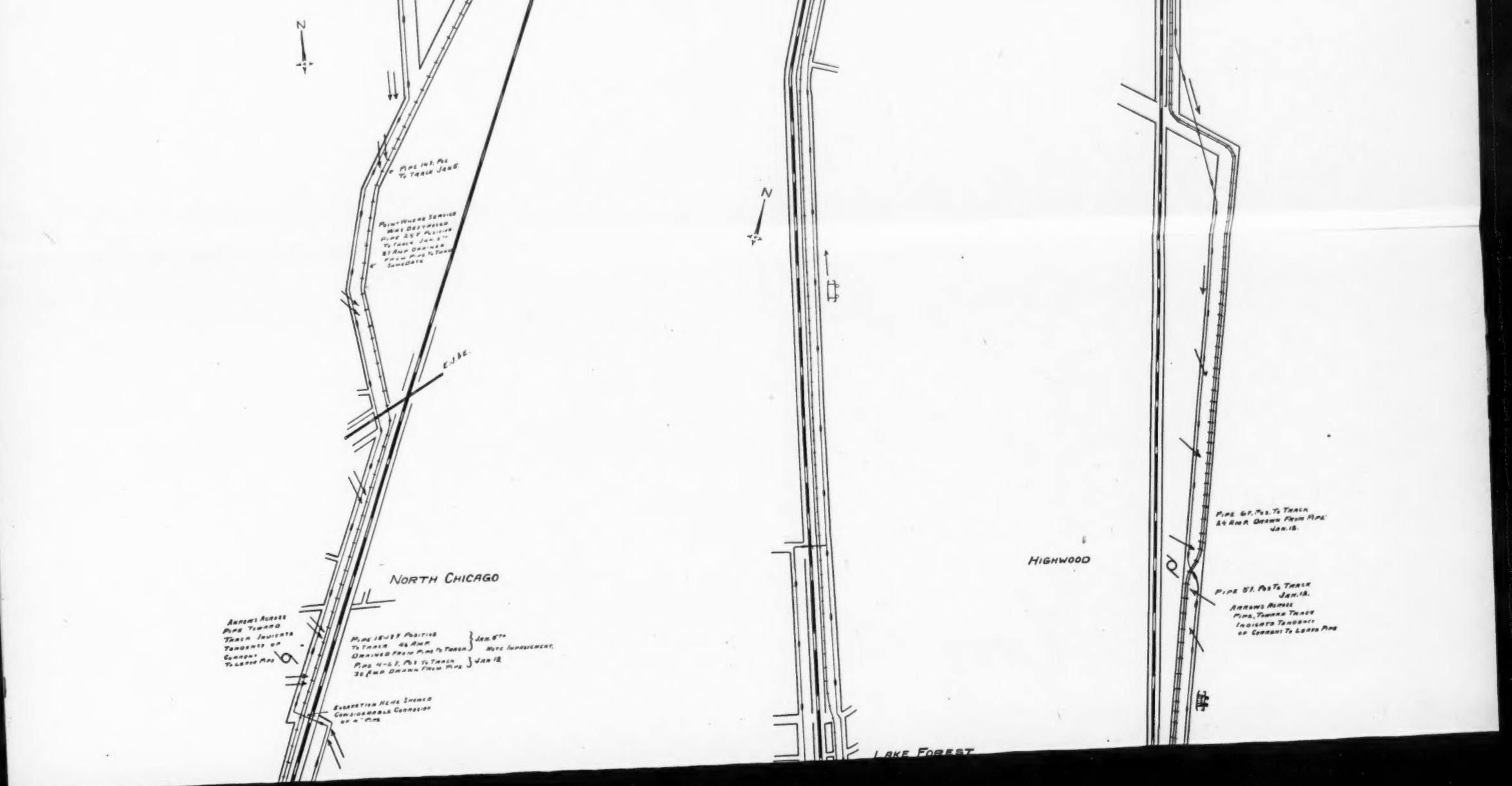
MAP & DIAGRAM SHOWING ELECTROLYTIC INFLUENCES AFFECTING PIPES OF THE NORTH SHORE GAS CO.

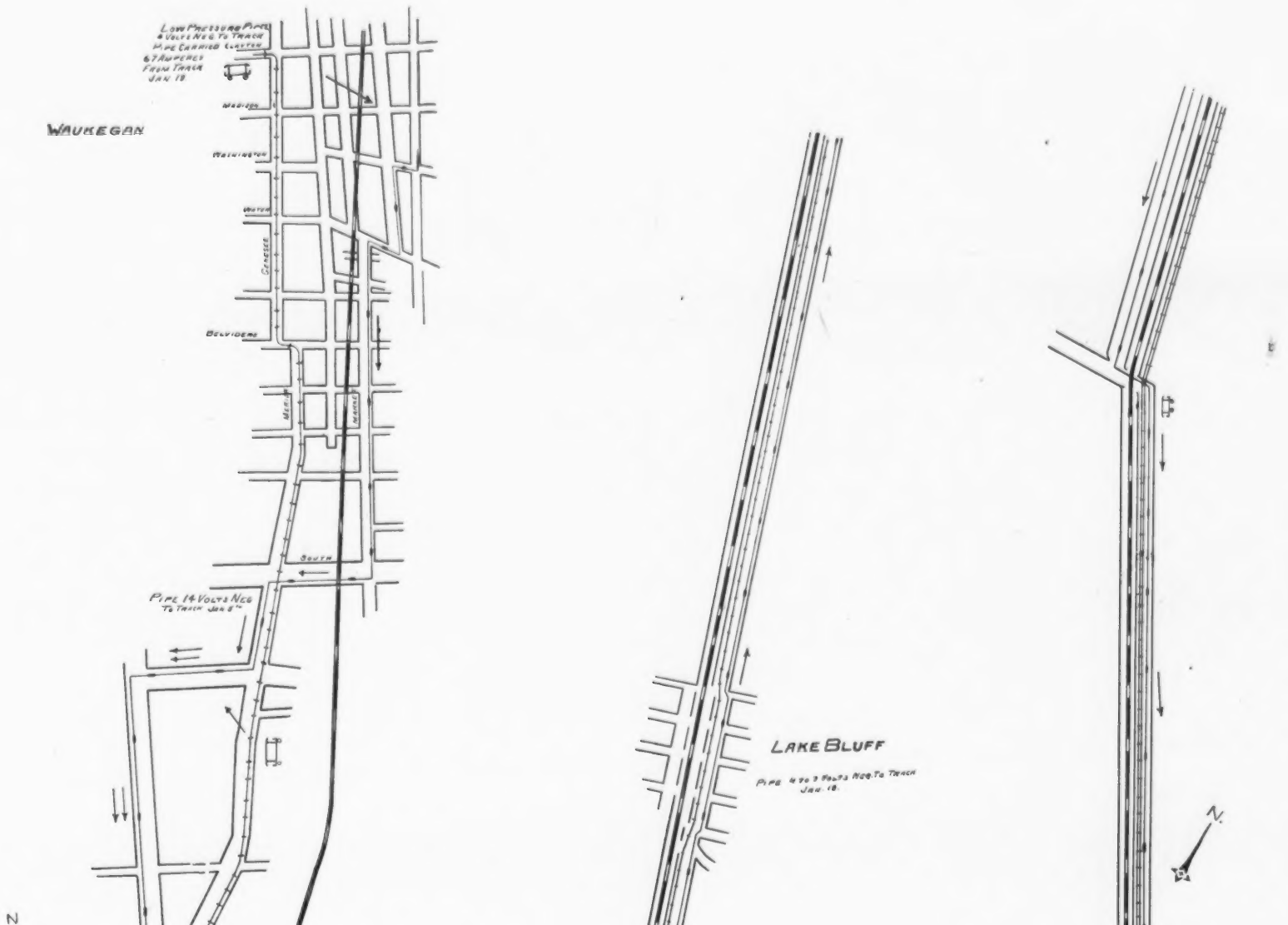
Scale 1½" = 1000' JAN. 1902.

C. & N.W. Ry.
C. & M. E. Ry. - Single Track.
" " " Double "
" " " Distributing Stations.
North Shore Gas Cos. Pipe Line.
Show Graphically The Direction of Flow of The Railway Return Current.

J. A. Hamilton

876 A


N
Pipe Inj. Pos To Track Jan 6
Point Where Service Was Destroyed Pipe 2.5 V Position To Track Jan 3rd 87 Amp Obtained From Pipe To Tower Shoreate
E.J.&E.
NORTH CHICAGO
Arrows Across Pipe Toward Track Indicate Tangents of Current To Leave Pipe
Pipe 16-3 V Position To Track 46 Amp. Obtained From Pipe To Track. Jan 6th Note Improvement.
Pipe 4-6 V. Pos To Track 36 Amp Drawn From Pipe Jan 12
Excavation Near Should Considerable Corrosion of 4" Pipe
N
LAKE FOREST
HIGHWOOD
Pipe 6V. Pos. To Track 24 Amp. Drawn From Pipe Jan. 18.
Pipe 6V. Pos To Track Jan. 18.
Arrows Across Pipe, Toward Track Indicate Tangents of Current To Leave Pipe


LOW PRESSURE PIPE
4 VOLTS NEG. TO TRACK
PIPE CARRIED CURRENT
67 AMPERES
FROM TRACK
JAN. 18
WAUKEGAN
MADISON
WASHINGTON
WATER
GENESEE
BELVIDERE
MARKET
SOUTH
PIPE 14 VOLTS NEG
TO TRACK JAN 6TH
LAKE BLUFF
PIPE 4 TO 7 VOLTS NEG. TO TRACK
JAN. 18.
N.

rather than special. I have not been able to find any data upon the application of this method to iron pipes. I am, however, quite familiar with its use on underground cables. In the city of Chicago the cables crossing the main branch of the Chicago river pass through a tunnel and come from the tunnel to an underground system on the North Side, which is generally under water. The cables pick up in the downtown district all of the current, which seeks them by the law of divided circuits, and takes it over to the North Side, where the current leaves them to seek the railway tracks. Corrosion has been entirely eliminated at this point by putting insulating splices in the armor of the cable in the tunnel.

At numerous other points these insulated splices have been found to be adequate protection for a single cable. There are a number of underground boulevard crossings, the cables in which are connected with the rest of the underground system by aerial cables. At most of these points it has been found necessary to put an insulated splice in the cable on both sides of the crossing.

This method was advised in the case of the high pressure gas line of the North Shore Gas Company. By referring to the folder it will be noticed that this line paralleled a trolley line for 13 miles. A survey of this line showed that the pipes were returning about 25 per cent. of the entire current to the different trolley stations, which were about 10 miles apart. The use of a return feed, which seemed especially promising at first, in this case turned out to be inadvisable, as the pipe line had an expansion joint about every 1,200 feet. These expansion joints were of the Dresser type with rubber packing, and it was thought that about 90 per cent. of them entirely interrupted the metallic continuity of the pipe. It would have been a somewhat expensive job to have bridged around all of these joints with a copper wire, and as the conductivity of the screw couplings was a doubtful question it was finally decided to secure if possible an improvement in the track return by the railway company, and to take some steps towards making the pipe as poor a conductor as possible.

The high pressure pipe is connected with the low pressure mains in Waukegan at the gas works. These low pressure mains ramify through the streets of Waukegan and pick up considerable current which passes around to the high pressure mains and follows them to the power station. For a half a mile south of the gas works the line lies in sandy soil, and insulating joints along here would probably be remarkably efficient. The interruption to the circuit offered by the expansion sleeves was not deemed sufficient to be of great protection. The pipe was cut in two places and reconnected by means of insulating couplings with rubber packing which were easily obtained. By this means an interruption of 10 feet could be secured, furnishing a path of very much higher resistance for the current to jump. The Fig. 6 shows the manner in which this joint is installed. The efficiency, as nearly as could be obtained, because of the fluctuating character of the railway current, was from 50 to 75 per cent., meaning that each such joint interposed would diminish the amount of current flowing in the pipes to from 25 to 50 per cent. of its original value.

All of these devices only mitigate; they do not eliminate the danger of electrolysis. The only absolute cure is a radical one; it means the entire insulation of both sides of the circuit from the ground. This involves the use of a double trolley system or some underground double contact device. It is often said that the electrical conduit road solves the problem. This is not true if the rails are used for the return circuit.

The ordinary single trolley track, return system depends for its usefulness upon what are usually known as "rail bonds," consisting of a bond of copper from the end of one rail to the next. These copper bonds are generally swaged into the web of the rail. They are of many types. When the electrical road first came into being the ground was deemed a sufficiently good return circuit for anything. It was soon found that the ground could not be entirely relied upon and that the coating of rust between the fishplate and the rail rendered this point a very weak one in the electrical circuit. The first improvement was suggested by a William Robinson, in a patent entitled "splices for electric track circuits." It consisted in a metal spring placed between the web of the rail and the fishplate, which was intended to insure good metallic connection between the rails even when the fishplates were loose. From this affair of very meager value the development has been rapid to the cast, welded and other approved joints of to-day.

It is fortunate that the use of Bessemer steel with a low coefficient of expansion became common before the single trolley system was born. Steel rails laid in pavements have comparatively little to contend with from variation in temperature. The cast, welded joint causes the tendency to expand and contract to be entirely manifested by internal strains in the metal of the rail. When one of these joints breaks in cold weather it can be noticed that the ends part several inches. The maintenance of bonds on track laid in pavements is easier because of the smaller amount of contraction and expansion with changes of temperature, and the bonds can be put outside of the fishplate without danger from the junk thieves, thus taking up such little of this action as does occur.

With an interurban road where the rails are laid above the ground the case is different. In order to secure immunity from theft it is necessary to put the bonds inside of the fishplates, thus making it difficult to secure room for a bond with sufficient elasticity. In any case, where a gas company can exercise sufficient influence to secure the adoption of a 60-foot rail by the railway company, this should be done; as with the 60-foot rail there are just one-half as many bonds, and, therefore, weak places in the track, as with a 30-foot rail.

When some studious genius evolves a storage battery which has about one-tenth of the weight per kilowatt hour possessed by the present lead storage battery, and with a lower cost of maintenance, the track return problem will be satisfactorily solved. It is probable, however, that before this is done some other investigator will produce a mechanically strong electrolysis proof pipe at a reasonable cost.

Discussion.

The President—I regard this subject of electrolysis as one of the most vital before the gas men of to-day; and I have been glad to get someone familiar with electrical terms and work of this character to prepare a paper for us. It is now before you for discussion, and we would all enjoy a vigorous debate on the subject.

Mr. Egner—In order to start the discussion I will state I was glad to see this paper, which I read on my way from New York. It evidences a thorough knowledge on the part of the writer of his subject, and what he states is well worth studying. I am also pleased to see that somebody has called attention to the ground plate, because at one time I thought I was the inventor of that plan and would get a revenue out of it. On the copies of the papers sent to me by the Secretary, and all of which I read carefully while on the way to New Orleans, I had various points marked to make inquiries about, but I have not got these copies with me now, and cannot refer to my notes, but I hope someone else will propound the questions concerning it, which I had intended asking.

Mr. Steinwedell—This subject has been agitated considerably at our meetings, and has been very ably written upon and discussed, but I felt when I carefully read the paper by Mr. Humiston that he put forth good ideas which put the subject in a different light from that we are accustomed to or have heard of formerly. I consider the deductions perfectly correct. I have had electrolysis to contend with, both from the standpoint of operating electric roads and from the standpoint of the gas manager; and I am sure, from all that Mr. Humiston has written, the Association is doubly indebted to him for having gone to the trouble of writing this paper.

Mr. Goodnow—With regard to insulating joints, I will say that it is very easy to add them to the line, section by section (I am speaking of a high pressure liue), the bolts and proper preparation being previously made, as necessary. The couplings we introduced were made with a rubber gasket, having screws for tightening the bolts. Joints of this character, of 10 feet or any other length, can be put in the pipe line in a couple of hours after the ground is open, so the interruption of a long line can be done on any day when the consumption is small and the amount of travel near a high pressure line is comparatively little. Of course, the facility with which this can be done would be greater on a low pressure line. I think these joints could be introduced in a cement joint or a cast iron one just as well by having similar construction. Another thing I would like to ask Mr. Humiston about is as to the character of the soil in which electrolysis action is most active; whether sandy, clay or loam, or made land? These are generally the soils that we run across, and the action in them is very important.

Mr. Humiston—For made lands, the filling may consist of anything from ashes and garbage to broken brick and plaster. Pipes imbedded in such compounds would be extremely likely to suffer from electrolytic action, if the influences were present. So far as my observation has enlightened me, I think that clay, loam and sand stand about in the order I have mentioned them for their tendency to electrolytic action. That is, there would be more corrosion in clay than in loam or sand. The nitrates and chlorides are the salts most commonly found in soils. A chloride is very nearly twice as active (considered as a medium of electrolytic action) as a nitrate. Wrought iron imbedded in pure sand, moistened with a one-third of 1 per cent. solution of sodium chloride and subjected to electrolytic action, would lose in weight .043 ounce per ampere hour. With a solution of sodium nitrate of the same density it

would lose .024 ounce per ampere hour. As these salts are very unequally distributed I think the reason for the difference in the effects of clay, loam and sand lies rather in the water retaining power of these mediums than in their chemical composition; clay, which stands first in this respect, being an insoluble silicate of aluminum. Loam has about 30 per cent. of the water retaining power of clay, and sand will lose water almost immediately.

On motion of Mr. Steinwedell a vote of thanks was tendered to Mr. Humiston for his interesting and valuable paper.

The President called upon Mr. W. E. Steinwedell, of Belleville, Ills., Editor of the

WRINKLE DEPARTMENT,

to present his budget of Wrinkles, which he did as follows:

The following contributions of new devices and methods in gas manufacture and distribution were received before this edition was closed on April 15.

At the Chicago meeting, in 1900, the Western Gas Association authorized the publication of all the wrinkles that have appeared in American gas circles, and with this in view, all the wrinkles to 1902 have been collected from files of the JOURNALS, or the printed proceedings of the Associations, and include:

"Progressive Age" Wrinkle Department, from January 15, 1891, to June 1, 1893.

Western Gas Association Wrinkle Department, from 1893.

Pacific Coast Gas Association Wrinkle Department, from 1895.

Ohio Gas Light Association Wrinkle Department, from 1901.

The Southwestern Gas, Electric and Street Railway Association begins its Wrinkle Department this year.

It is hoped that during another year the cuts can be collected, wrinkles properly arranged, and the publication completed.

No. 1.—*Standpipe Cleaners for Top and Bottom.*—Mr. John H. Fitzgerald, of Houston, Texas, sends an illustration of standpipe cleaners, which give good satisfaction. The one with the straight handle and spurs turning towards the point is used from the top, and

Wrinkle No. 1.

the one with the bent handle is used from the bottom at the mouthpiece. The heads are made of 1¼-inch square steel, and the spurs of ⅝-inch square steel.

No. 2.—*Two Holders Used as One.*—Mr. C. M. Keller, Columbus, Ind., contributes plate of 2 gasholders used as one. The gas goes into the large holder and passes through until the smaller is filled, when it strikes the stops. Then the large holder rises until full, and can blow off in the usual way. In this manner the two holders are used as one without the need of opening or closing any valves, and are automatic in their action.

No. 3.—*Circulation to Prevent Freezing of Holder Tanks.*—Mr. W. A. Bixby, of Decatur, Ills., on prevention of freezing of holder tanks, furnishes the following:

A water pipe *W* runs from the center of the holder reservoir to the steam-jet pump *J*. The steam pipe *S* also connects with this pump, and is provided with a valve *V*. Upon opening the valve *V* water is taken from the warmest part of the tank and delivered to the point most susceptible to freezing; at the same time imparting a current to the water in the annulus of the holder tank. In large holders two or more such contrivances can be used.

No. 4.—*Method of Depositing Bills in a Bank.*—Mr. W. A. Bixby, Decatur, Ills., also gives this method of collecting bills through bank: When any of our consumers complains of its being inconvenient to come to the office to settle, or gives an excuse for not paying before the 10th, we ask him to sign a slip as follows:

.....Bank,

Please accept my gas and electric bills from the Decatur Gas and Electric Company, until notified to discontinue same.

.....

Consumer.

This is deposited with his first bill, and all later bills are deposited until he gives us notice to discontinue. The blank space at the top is filled in with the name of the bank with which the customer deals. Then each bank has a list of the bills which are deposited with them made out on the opposite form. Only the amount is noted, care being taken to place the bills in the same order as the amounts are set down. Our collections by this method amount to about $2,000 per month from about 500 bills, and we are constantly adding to the number.

No. 5.—*Portable Sign for Main Laying.*—Mr. C. L. Gerould, Galesburg, Ills., makes these suggestions as to laying new mains: The portable sign is used on all open trenches, especially when laying new mains. It is a fine advertisement, and usually brings the house owner along the new trench in conversation with the foreman, who then gets the service application.

No. 6.—*Scurfing Retorts with Air Blast.*—Mr. H. E. Chubbuck, Quincy, Ills., has made a success of scurfing retorts in the following manner: If we can free the retorts of carbon without disturbing that in in the cracks and joints we save much gas. To this end we have applied a jet of air, so arranged as to play at the center of the retort end, thereby cutting the heavy carbon end piece and freeing the corner pieces.

We do not claim anything on the air jet, but think we have a very handy and successful method of applying the same. We use a small ¼-horse power, alternating current motor, direct connected to a No. 2 Buffalo pressure blower, and have same fastened to the wall in an out of the way place, and permanently piped to our benches of sixes. The outfit gives 170 cubic feet of air per minute at a pressure of 1½ ounces, and runs at 3,400 revolutions per minute. Six-inch galvanized iron piping is run along the top of the benches with 4-inch branches down the center to the level of the middle retorts. Here we use a thimble cap when not in use, and flexible ells to make the connections when scurfing. For the pipe inside the retorts, old boiler tubes 2½ or 3 inches in diameter are used, as these burn up in about 2 scurfings.

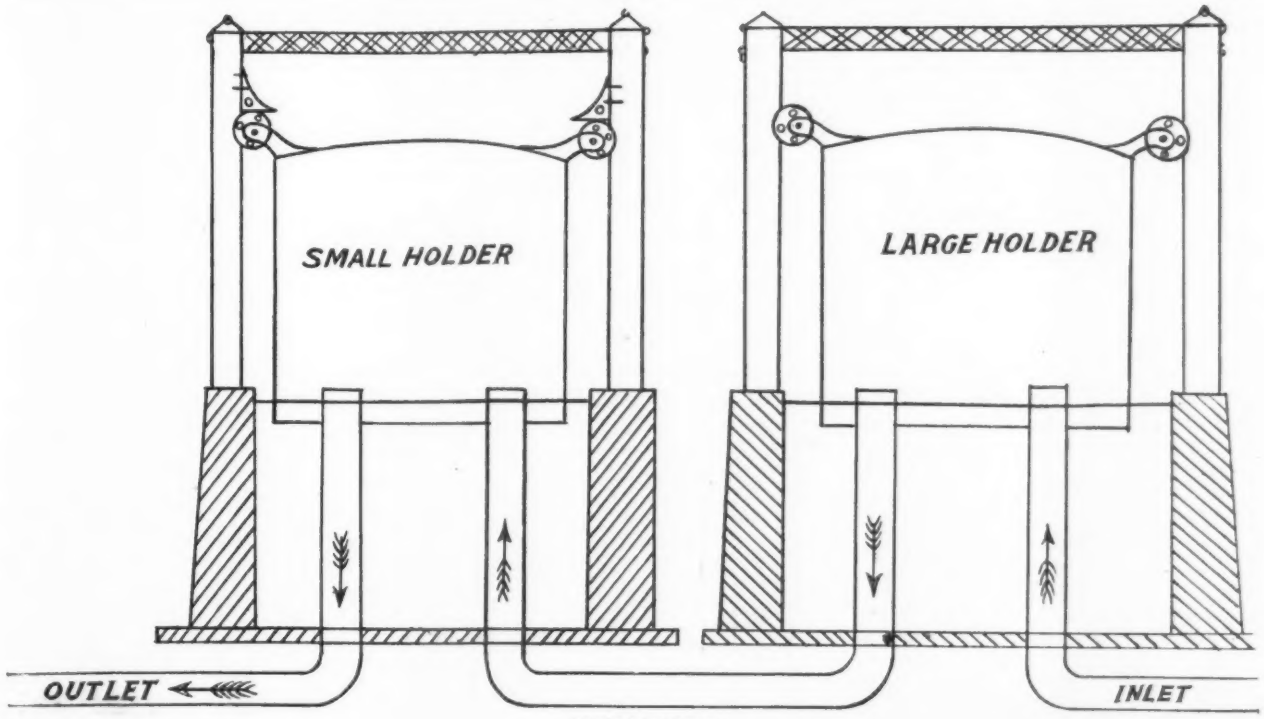
With fair heats, retorts quite heavily carboned are scurfed in from 6 to 8 hours, and in a slightly longer time with lower heats. This before the retorts or joints open up; and in comparatively short time when the works are taxed with large send outs. The cost of the outfit, including fan, motor and pipe for 4 benches, was about $90, and when an electric plant is run in connection with the works the cost of operation is practically nothing—200 watts per hour.

No. 7.—*Device for Cleaning Service Pipes.*—Mr. C. H. Nutting, Chicopee, Mass., kindly contributes the following: I have in our office a 5-horse power gas engine, connected for show purposes. This engine has a self-starting arrangement, consisting of an air tank of about 10 gallons capacity, and when pumped ready to start the engine, contains 80 pounds pressure.

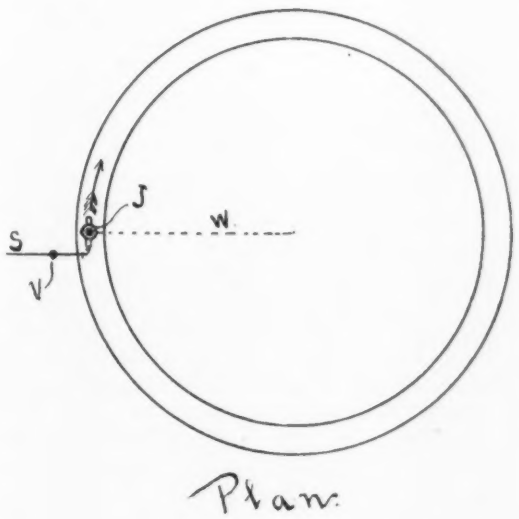
Frequently I would find that the men had disconnected this tank and used the contents to blow out a service, and when I wanted to show the engine to someone there would be no air to start it with.

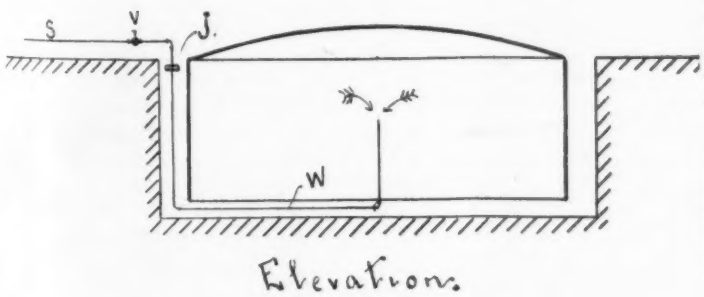
I then bought a 10-gallon tank and a hand air pump the outfit costing $17—and now when a service needs to be blown out, the men always carry this tank, and I find it gives thorough satisfaction. It takes 5 minutes to pump this tank up to 50 pounds, and 10 minutes to pump up to 80 pounds pressure.

No. 8.—*Testing Plant for Coal Gas.*—Mr. W. A. Baehr, Denver, Col., says: In one corner of our retort house cellar we erected a corrugated iron shed, and in it put a small Roots exhauster, a hot washer, pipe condenser, ammonia scrubber, purifier and small station meter.



Wrinkle No. 2.





Wrinkle No. 3.

THE DECATUR GAS AND ELECTRIC COMPANY,

.....190..

.....*Bills listed at*

.....*Bank.*

Wrinkle No. 4.

NOW IS THE TIME
TO HAVE YOUR HOUSE CONNECTED
TO THIS NEW GAS MAIN
GAS FOR LIGHTING AND A GAS RANGE FOR
COOKING ARE CHEAPEST AND BEST.
CALL AT THE OFFICE OF THE
DECATUR GAS AND ELECTRIC LIGHT CO

Wrinkle No. 5.

The exhauster has a 2-inch bye-pass with a stopcock in it, and since it is driven by an electric motor we secure the proper regulation by means of the stopcock in the bye-pass. This plant is of such a size that it readily handles all the gas made in one of our regular retorts. After passing the station meter the gas is conducted to either a photometer or back into the regular foul main.

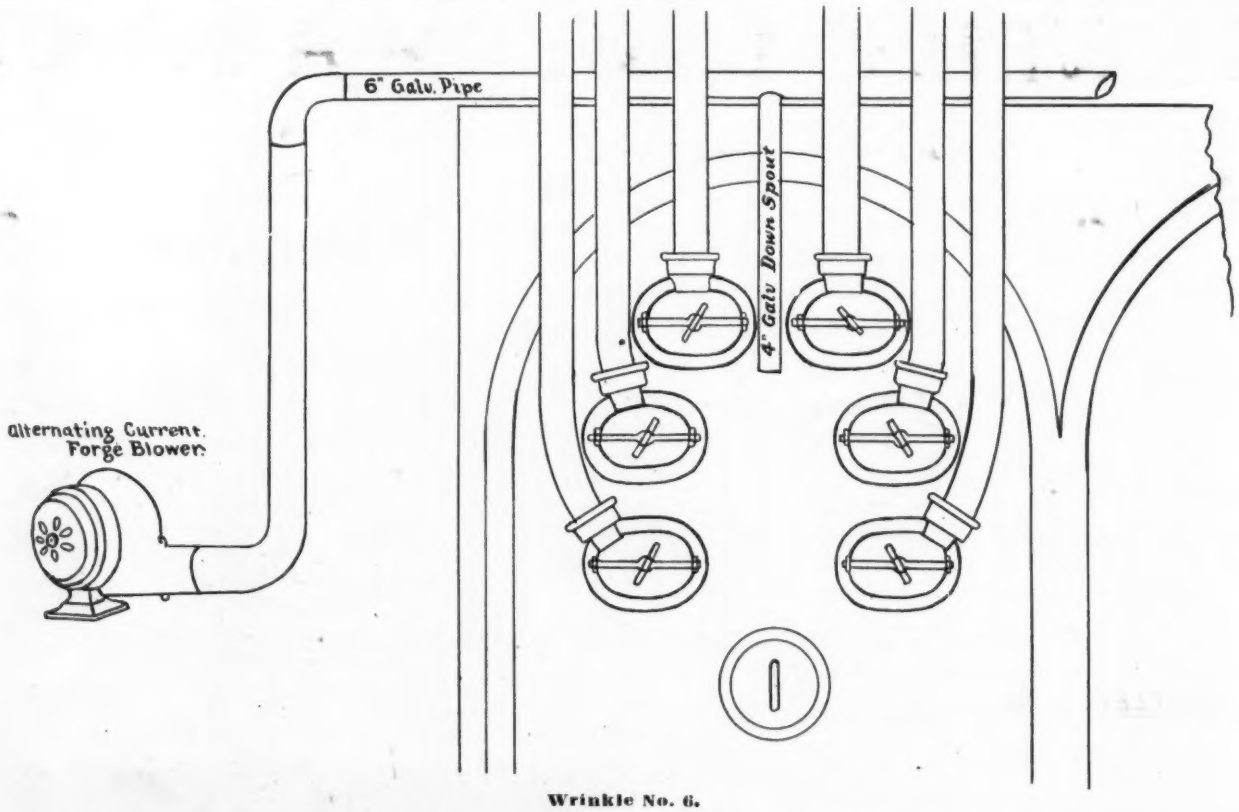
The object in using one of our regular retorts is to secure working conditions. In this plant we have tested 20 to 30 different kinds of coal, securing the following data for each kind:

1. Gas made; 2, coke made; 3, tar made; 4, ammonia made; 5, complete gas analysis; 6, candle power.

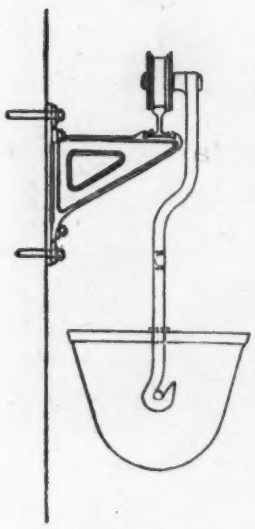
We will say, from our experience with this plant in Denver, that we have found it very useful and would not be without it.

No. 9.—*Wrinkle in Operating Water Gas Plant.*—Mr. W. A. Baehr, Denver, Col., on the matter of water gas economy, writes: We find quite a saving in the operation of our water gas plant by opening the blast valve on the generators at the end of the run before opening the stack valve.

When the run is over the operator opens the generator blast valve, walks to the steam valve and shuts that, and then walks to the stack valve lever and pulls it open. It averages 12 to 15 seconds from the time of opening the generator blast to opening the stack valve. During this time most of the remaining gas in the carburetor and superheater is driven past the seal by the blast, thus saving what would otherwise be lost.



Wrinkle No. 6.



Wrinkle No. 10.

No. 10.—*Conveying Coal by Hanging Railway.*—By the Editor.—In some works where the coal storage is quite a distance from the retort house the hanging railway and car shown are found advantageous for bringing the coal to the front of the stack. The car tips sideways and is easily pushed by hand.

No. 11.—*Drip Pot.*—By the Editor.—This drip is of advantage in reconstructions, as the slight fall in the level of the tar and ammonia liquor is often greatly desired to give sufficient drop to the wells. The tar and ammonia enter by the 3-inch connection, and, after passing down and under the seal, run to to the cisterns from the 4-inch opening. The other three hand-plate openings are for cleaning.

No. 12.—*Compact Station Meter Connections.*—By the Editor.—This arrangement, consisting of 3 angle valves, cuts the cost of piping by two ells and one T, and proves a great saving in cellar space. The drawing is self-explanatory.

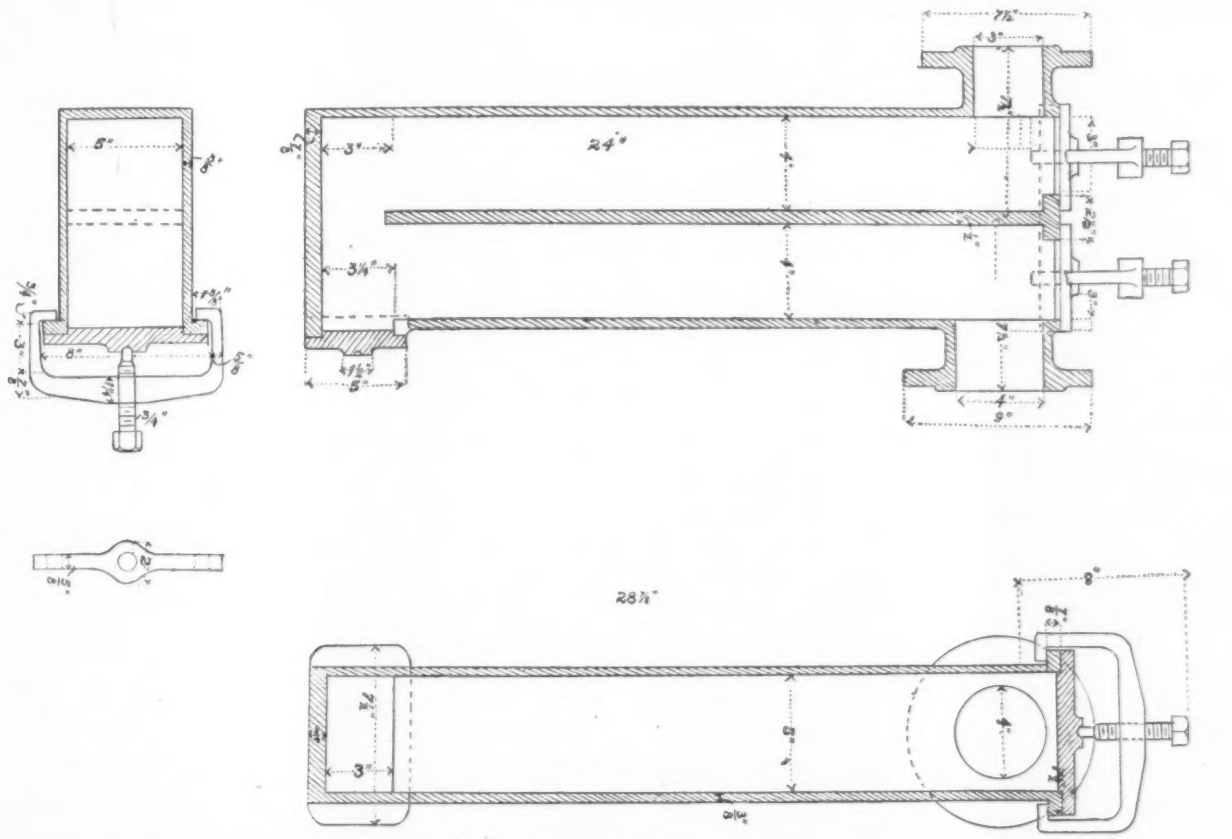
No. 13.—*An Advertising Scheme.*—Mr. B. A. Block forwarded the following too late for printing in the advance pamphlet: Take a barrel and nail rough slats across it. Put on a sign, "Hands Off!" This will make everybody curious to learn what sort of an animal or large bird is contained therein. Where the dotted lines appear, place a card, about the middle of the inside, reading, "Why don't you cook with gas?" Scatter about town.

Wrinkle No. 13.

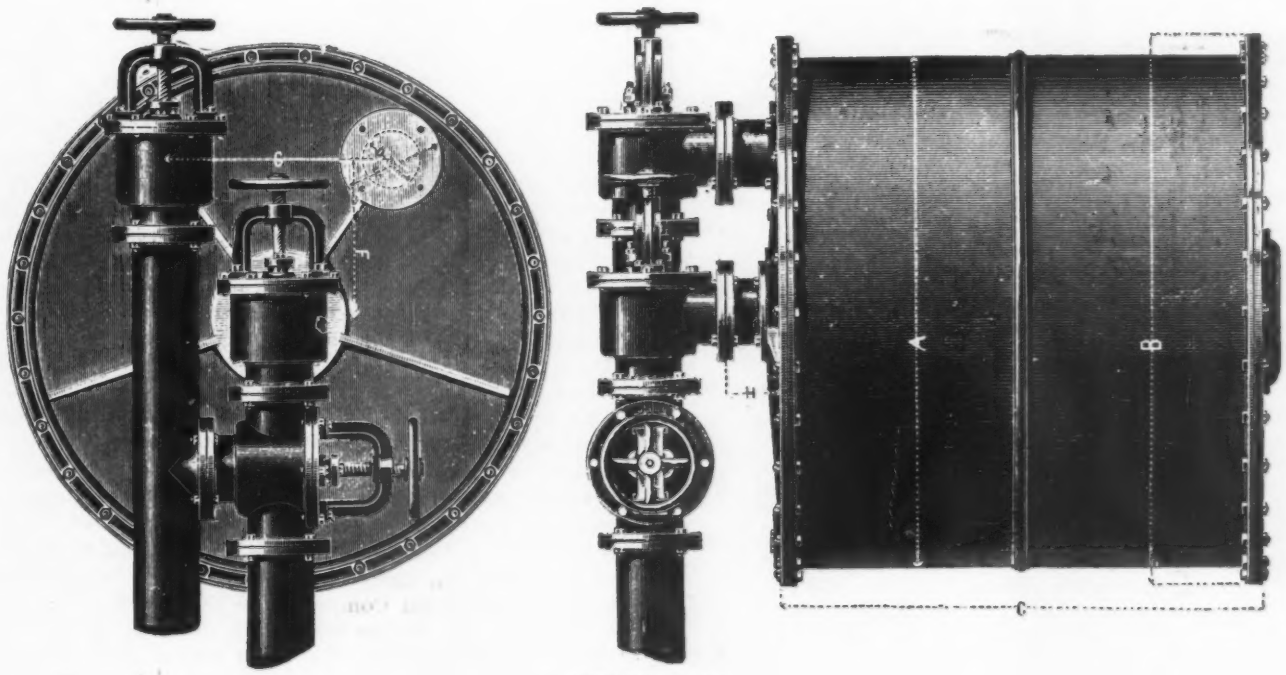
Discussion.

The President—Gentlemen, Editor Steinwedell's interesting collection of Wrinkles is before you for discussion.

Mr. Egner—Mr. President, as no one seems prepared to rise to discuss Mr. Steinwedell's paper, I will—to quote a dear old friend of mine and a fellow member of this Association whom you all probably know, Mr. James Green, of St. Louis—"start the ball a rolling" before a vote of thanks is moved for this to me quite unexpected array of Wrinkles. When I had the honor to put Mr. Steinwedell in nomination for the office of Editor of the Wrinkle Department a year ago, I was fully aware of the difficulties he would encounter in making a creditable presentation; for it must be remembered that he has had a number of predecessors among whom were some of our ablest members; and this, when Wrinkles were still an innovation and plentiful. But after several years of other Associations' activity in the "Wrinkle Departments," along with our own past Editors' laudable efforts in that field, I wondered how Mr. Steinwedell would come out, and am most agreeably surprised at what he has been able to present to us. I think Mr. Steinwedell deserves a real hearty vote of thanks under the adverse circumstances which he had to face. Among others, no doubt, he also asked me to send along something if I could. I promised to do so; but being so very unsettled, as I have been now for nearly 8 years, frequently on the road, never long at any place, it slipped from my mind. But I have the pleasure to make a contribution here; and as it is one that by personal observation I can vouch for as really valuable to those so situated that they can apply it, think it better to give it now rather than to put it off until next year; but please consider it as a contribution due to Mr. Steinwedell's efforts. The author of it is Mr. George Henry Brown, the very capable Superintendent of the Morristown (N. J) Gas Light Company. Mr. Brown, while still a young man, is quite "old" in the gas business in a practical sense. He served "under instruction" with me at Norfolk, Va., where he went through every branch of coal and water gas manufacture, perfected himself in the coal gas branches at the late Metropolitan gas works of New York city, worked as an erector with Messrs. A. O. Granger and Company, where he obtained additional information as a water gas man; was for some years with the Peoples Gas Light and Coke Company, of Chicago; then as my assistant at the old Laclede works of St. Louis; and subsequently Superintendent of what is now "Station B" of that Company; and for the past 11 years he has been Superintendent of the Morristown Company. While looking over some foreign gas journals last summer he saw something he said he would try. He said that in fact we had done this thing at the Laclede works 12 years ago, but I did not remember it. I think Mr. Brown deserves the whole credit of what he has done. And this is what it is: He had made for him at a nearby boiler shop works a water gas generator shell, 12 feet 6 inches high and 6 feet outside diameter. This he had lined with firebrick, many of which he had on hand from tearing out old benches. He used some old Roots' valves as the quick opening valves needed, bought at second-hand a counter shaft, wall brackets and pulleys and a small engine, converted one of



Wrinkle No. 11.



Wrinkle No. 12.

his small gasholders into a relief holder, and then commenced the making of blue or uncarbureted water gas, filling his relief holder of about 30,000 cubic feet capacity. He also drilled holes through the back walls of his coal gas benches and retorts, connected the outlet from the holder through a meter and so forth to a ¾-inch pipe leading into and just projecting inside of the backs of his retorts. Then he turned on the gas experimentally. That is to say, he turned the water gas into the coal gas retorts in the manner described, and in varying percentages. He has no bar, but only a jet photometer, which, however, is accurate enough to indicate any falling off or increase in illuminating power. His benches are 6's, of which he has 4. To date, the experiment, which was started about the middle of last January, has been extended to only 2 of them, as that is about all he required to be kept under fire. He charges from 300 to more pounds of coal per retort in 4-hour charges, and, calculating the yield per charge, aims to put from 15 to 20 per cent. of uncarbureted water gas through each retort along with the coal gas. This he found he could do without appreciable reduction of candle power, the coal and water gas going together through the coal in the hydraulic main, since both must pass through the same ascension pipe from the retorts. He has passed as high as 40 per cent. of water gas through in the manner indicated; but then the illuminating power suffered 3 or 4 candles, and he turned on some oil to act as an enricher—also some cannel, which acted very well. At first he ran the water gas through small, wrought iron pipes extending from the mouthpieces of the retorts to the back of same. As the pipes would quickly stop, that method had to be abandoned. So he hit upon the plan of drilling through the back wall of the bench and retort, and has had no trouble since. What all this means in an economical sense you can figure out for yourselves; or what it might mean to you if you are situated so that you could do the same thing. Mr. Brown tells me that he can make

about 5,500 to 6,000 cubic feet of blue water gas per hour with his generator. Sometimes he fills his holder, some days he will run only a few hours. In a small works like this, he takes the men as he can find them not busy at other things, and he is not above taking off his coat occasionally, if need be, and no one else can be spared, and fill a holder full of the water gas until maybe he can spare a man from other work. When through making water gas the generator is closed up, leaving only enough draft to keep the fire from going out, and when wanted he can roll off his quantum of water gas at very short notice. He uses the retort coke made on the premises. I do not remember how much coke per 1,000 cubic feet he uses; but he makes very quick runs, having no carburetor to heat up, and I think his results are quite good all around. The whole cost was, I think, less than $700, since much of the material was second-hand, or some which he picked out of his scrap heap; as, for instance, the Root valves, for which he had no use, they being left over from a disused exhauster they had had at an older works. He has not only cheapened his production, but in a very efficient manner increased the producing capacity of his works at a comparatively trifling expense. Mr. Brown told me that he intended to send this Wrinkle to Mr. Steinwedell, though he is not a member of this or any other Association. But Mr. Brown is no "talker" or "writer," and in that way the matter was left. But I am sure that Mr. Brown is entirely satisfied that I should give you the information now before you, and which it is hoped may be of sufficient practical value to excuse the time expended in this statement.

Mr. Norris—It would seem queer to me that a pipe carrying only blue gas, when introduced through the front end of the retort should stop up tight.

Mr. Goodnow—I would say the obstruction in the pipe became very hard. I think the water gas in connection with the iron formed a carbonate of the latter.

The President—In order to get the blue gas, he must have had in use one of the old processes.

Mr. Goodnow—How about the small blower and the small engine which costs less than $700? He had it in and that was the result, and with his blue water gas apparatus he tried it and everybody was highly pleased with it. He wanted to put in a good water gas set, but as he was not allowed the money he put in this, and as it is working satisfactorily the investment was justified.

Mr. Barthold—In 1899 we tried a similar scheme. We tried 10 per cent. and found that it decreased the candle power. We did this with another end in view, viz., to see what effect it would have on the yield of ammonia. While admitting this amount of blue gas, we were making tests for amount of ammonia in crude coal gas, and we tried the plan, with a view to determine its effect on the yield of ammonia. We thought the hydrogen in the blue gas would have some influence on the production of ammonia, but our results showed no appreciable change.

The President here named the Committee to Consider and Recommend the Next Place of Meeting, after which the sessions were adjourned to the following day, at 10:30 A.M.

[To be Continued]

Experiences in Incandescent Gas Lighting in the Antipodes.[1]

The progress made by Australasia during the past half century has rightly been described as "wonderful;" and under the new Commonwealth *régime*, it is anticipated that development will continue at even greater pace, with an attendant increased prosperity. Australasia has in its favor area, material wealth, and all the vitality of youth. An innate enthusiasm dominates the actions of its people, and new ideas are germinated and developed with remarkable vigor and rapidity. All that is done does not perhaps commend itself to the more sober view of the Mother Country; but in many respects the people are not so slow as the Mother Country in laying hold of that which is good, and using it, with ready adroitness and to its utmost extent, for their own benefit. We have an example of this in incandescent lighting. Taking the country through, we can do doubt at home show—merely through the largeness of population—a big adoption of incandescent lighting; but not that general adoption which there ought to have been at the present day. But in the large cities and the ordinary towns of Australasia, albeit they are on the other side of the globe—far from the birthplace of incandescent gas lighting—we find that the gas companies years ago, aided by the enlightened Company who control the patents there, saw that in the new method of lighting they had a poignant weapon, which, if actively used, would keep at bay the electrical foe who was at the time eagerly seeking to land and establish itself in many places. It is true the landing and the establishing of works have been accomplished; but the skilful way in which the gas companies have pressed into use the incandescent gas burner has not left a very fertile field for the opponent. For the heads of the gas companies there, there has been no sitting in the office chair, and waiting for consumers to come to them to learn of the new form of lighting, nor has it been left to the doubtfully tender mercies of traders, who, in this country, had no encouragement to push the light other than a very slender, and in some cases an unremunerative profit. No, the Australasian companies bestirred themselves, and took the light to the consumers; and the consumers welcomed it.

A chance conversation brought us into contact the other day with the work of the Australasian Incandescent Gas Light Company, and gave an opportunity for a chat with the Managing Director of the Company, Mr. A. E. Cohen. This gentleman talked interestingly on incandescent gas matters for the greater part of an hour; and he was so full of entertaining experiences that, had he been pressed, we have not the slightest doubt but that he would have carried on the conversation so long as we had pleasure in hearing him. But Mr. Cohen is a busy man; and we had no desire of intruding upon him at too great a length in the hours which claim his close attention in looking after the needs of Australasia in the matter of incandescent gas lighting. Before speaking of general matters, Mr. Cohen was much interested in a statement which appeared in the last issue of the *Journal* in the course of the address of the Chairman of the Melbourne Gas Company (Mr. John Grice) to the shareholders; and Mr. Cohen took that as his keynote. He thought it a pity such a statement should be lost to English companies: and therefore that it should receive more prominence. We have pleasure in giving it here. Mr Grice said:

In the year 1898 the Company sold about 983 million cubic feet of gas; in 1900 about 1,072 millions, and in 1901 about 1,127 millions. The sales last year were therefore upwards of 5 per cent. in excess of those of the previous year, and nearly 15 per cent. more than those of 1898. This advance must be taken in conjunction with the fact that in the State of Victoria, since 1894, Welsbach burners to the number of 95,000 had been sold—9,800 of them last year by the Company's Stove Department. The reduced price of these burners had brought within the reach of all the opportunity of obtaining a splendid light at a moderate cost. Consequently, notwithstanding the diminished consumption by each individual who had the benefit of the extra brilliance given by that most perfect light, the Company's principal business had increased at the rate of 5 per cent. during the past 3 years.

The figures as to the number of burners sold by the Melbourne Company are truly remarkable; and we know of no gas company in this country who could say that last year they *sold* 9,800 incandescent burners, or, in fact, anything more than a shadow of that number. And yet the Australasian Incandescent Gas Light Company control the incandescent market of the Antipodes precisely as the Welsbach Company have done in this country. By this, we do not suggest that the past commercial policy of the two have been similar. We merely mean that just as the patents are held in this country by the Welsbach Company, so the Australasian Company hold them for Australia and New Zealand. It is evident, however, that the Australasian Company have worked well with the gas companies. But speaking of patents reminds us of one point in the conversation with Mr. Cohen, which brings home a difficulty, but one that has not retarded progress. The Australasian Company are hampered in a way which is not, we believe, the portion of any other Welsbach Company in existence. They are carrying on their operations in 7 distinct countries or States—New South Wales, New Zealand, Queensland, South Australia, Tasmania, Victoria and Western Australia—each with its different legislation and patent laws. Each State has its own requirements and different laws; and what will sell in one State will not sell in another. Even under the Commonwealth, now that the States are equal, they retain their individual identity. If a man infringes the Company's patents in precisely the same way in the 7 States, then there are 7 patent actions for the Company to fight. For the Company, this is not a very cheerful state of things; but they have successfully defended their rights to the present time. On their 1894 patent (which is equivalent to the celebrated 1893 patent here), they have won all along the line. Then, again, what will sell in Sydney will not sell in Melbourne on account of the differences in the climate; and so the Company have to make provision accordingly.

Mr. Cohen has been in nearly every corner of the globe where gas is used; and when he was in Australia during the Commonwealth celebration one thing which struck him—and him more than others perhaps on account of his interestedness—was how remarkably general in-

1. *Journal of Gas Lighting.*

candescent gas lighting has become there as compared with any other part of the world where it has taken root. Even in Germany, which is confessedly ahead in incandescent lighting, there is not, population for population, such a preponderating use of incandescent lighting. This, he declares, to be undeniable. When his Company first started in 1893 they found the gas companies of Australasia almost in a state of panic, or any way in a state of fear. A tremendous boom in electric lighting was looming on the horizon. Directly, however, the incandescent burner was taken to them, they did not (as did the companies in this country for a time) look at it askance; but they received it with open arms as a means to salvation. The instances given to us of the enthusiastic way in which the gas companies used the incandescent burners with good effect, and in no half-hearted manner, are many. Mr. Cohen believes (Japan excepted) New Zealand has the cheapest electricity supply in the world, owing to the enormous water power available; but some of the gas companies have successfully met the competition by going to the length of buying incandescent burners, and putting them into the consumers' houses *feee of cost*. The Christchurch, Auckland and Wellington Companies are examples of this. This has proved a great inducement to the consumers to retain gas, rather than go to the expense of fitting up their houses for electricity. Speaking generally of Australasia, Mr. Cohen claims for the incandescent gas burner, and the enthusiasm of the gas companies in pushing it, the credit of having kept electricity in greater check than has been the case in any other country. What electricity is used for private purposes is, as a rule, obtained by isolated plants, driven by gas engines. This is so in parts of New Zealand—Auckland, for example—and therefore what the companies lose in lighting they get back in supplying power.

In the matter of public lighting, and more particularly in connection with the competition of the incandescent gas burner with electricity, Mr. Cohen had a good deal of information to impart. He claims for his Company the honor of having been the first to receive a contract of considerable magnitude for street lighting by incandescent means. This contract was for the streets of Sydney; and the number of lamps was 14,000. This was a single contract; and it is an illustration of the heartiness with which the then Australasian Colonies took up the incandescent gas light. Then, in connection with public lighting, niggardliness is something that is unknown there; and incandescent burners are used with great liberality. The lamps are set up at very short intervals; and in some streets of Sydney—Pitt street for example—will be found, in parts, clusters of 5 and 7 "C" burners. Now when we come to compare this with the meager way in which many of the streets of London and the suburbs (we need not go further afield) are fitted with contemptible single burner lamps located at considerable distances from each other—well, we can only admire the go aheadedness of the local authorities and gas companies of Australasia, and lament that we cannot import a few of them over here to give their English contemporaries lessons in lighting enterprise. It is true that the principal parts of Melbourne are lighted electrically; but Mr. Cohen's honest opinion is—and he thinks most people who have had the opportunity to make the comparison will agree—that the streets of Sydney, with their incandescent gas lamps, present a far more pleasing appearance. While speaking of outdoor illumination, it may be noted that last year the incandescent gas light succeeded in driving the electric light from the harbors of Melbourne and Wellington, and from the city of Christchurch. In these places, the electric lighting plants have been taken down, and incandescent gas "arc" lamps now reign in their stead. Akin to street lighting, is the illumination of public buildings; and it is of interest to learn that every Government office, post office, railway station, and place of worship in Sydney is lighted by incandescent gas burners. This reference to outside lighting, too, would be incomplete without some mention of the veranda lighting, which Mr. Cohen tells us is not an unimportant feature of his Company's business. Houses in Australia are generally built with an outside veranda; and the people spend a good deal of their leisure time on these verandas, to light which windproof incandescent gas lanterns have been largely adopted.

A difficulty that Australasia has to contend with in incandescent lighting is one with which happily we have little or no acquaintance in this country, and that is trouble from insects. For instance, Mr. Cohen tells us that particularly in North Queensland the nuisance is very great. The insects swarm there, and formerly they worked sad havoc with the mantles. It took a considerable time to effectively overcome the trouble; but it has been accomplished by devising a special burner, cased with gauze both at the air inlets and at the top.

In regard to private lighting, our informant mentioned the somewhat peculiar fact that in Australia and New Zealand the people are not quite so particular as in this country about using ornamental globes and shades. In many cases they will buy the burners, chimneys and mantles, but nothing in the way of ornamentation to get an artistic effect. At the same time, the Company do a very good business in incandescent accessories, which shows that the peculiarity is not general.

It seems to tickle Mr. Cohen's humorous side immensely to find the seigniors of the British gas industry talking and writing gravely about the wisdom of adopting the system of maintaining incandescent burners at this time of day; seeing that in Australia they have actually been doing it for the past 8 years. In fact, they boast of more maintenance business there than in any other country, excepting perhaps Canada. The reason for the exception is that the Welsbach Company in Canada, while their patents lasted, did not sell burners. They only hired them out; and it was done on the maintenance system. However, the Australasian Company have had a good deal of trouble with maintenance, owing to the rough usage of the lamps. It is no uncommon sight, Mr. Cohen informs us, to see in Australian cities—even in Sydney—where people ride a lot, 3 or 4 horses tied to a lamp-post; and the result is somewhat disastrous for the mantles, and unfortunate for his Company, who have to maintain the lights. It will be of interest to English readers to note—this drawback notwithstanding—that the Company have succeeded in reducing the consumption of mantles in the street lamps to the very low average of 2 per burner per annum—this being lower than most companies can lay claim to in this country. This average applies generally in Australia, and is scarcely ever exceeded even for harbor use. The mantles seem to come more frequently to a violent end than to dismissal through exhaustion; for, following up this statement regarding the lowness of the average replacements, Mr. Cohen told us that in Sydney and other parts there are often sudden and destructive wind storms. The day may be quite peaceful, and yet within 5 minutes there may be one of these calamitous wind storms. Then next day some thousands of wrecked mantles require renewing. Besides outdoor maintenance, the Company do a large business in the same line in private and public buildings. The charge is made on a sliding scale, according to the number of burners in the installation. Uniformed inspectors go round regularly once a week, and clean the chimneys, clear the burners and replace broken mantles. The Company work out an average of replacements; and it ought to come out even all round. In certain saloons, where a rowdy section of the populance assemble, and breakage of mantles is a common occurrence, then the Company either refuse to continue them on the maintenance system or charge a higher premium. Where there is a keenness of competition with electricity, a reduction of the scale of charges is found to pay.

In connection with the coming Coronation festivities and illuminations, it may interest gas engineers to know that, during the Commonwealth celebrations in Australia last year, incandescent gas lighting played an imposing part; and some very effective and artistic displays were made with it. Wynyard Square in Sydney was illuminated entirely by high pressure lights (Keith's compressors being used); and a very brilliant effect was secured. There was great competition between gas and the electric light for whatever glory was attached to making the finest display; and, on all hands, it was admitted that the incandescent gas lighting was infinitely more brilliant. The square named is a park-like place situated at the upper part of Sydney; bands play there; and it is quite a public resort. So that to make a good display was imperative; and it was done. Perhaps the hint may be of use to gas engineers at home.

We have already spoken of some of the drawbacks which incandescent lighting suffers in Australasia; and there are others. In inquiring of Mr. Cohen as to the charges for incandescent necessaries, he pointed out that 25 per cent. duty had been inflicted under the new Commonwealth; and there was also the freightage to be considered. But, notwithstanding, there is very little difference between the prices charged in Australasia and at home; the difference being slightly in favor of this country. Then the enormous hinterland of Australia is, under present circumstances, a disadvantage to the rapid extension in outlying towns of a system such as that of incandescent gas lighting; the goods having frequently to undergo a journey of some 5 or 6 days' duration to reach their destination. For the production of the mantles for Australia, the Company have a factory in Sydney, and for New Zealand one in Wellington. The last named has only been recently established. When Mr. Cohen was at the Antipodes last year, he found it was imperative to set up this factory, owing to the fact that, on the advent of the new Commonwealth, a uniform tariff of duties came into force for the whole of Australia; but New Zealand has not joined in. Therefore it was advisable to establish fresh works in New Zealand so as to feed the market there. An almost amusing incident, but one

which has its effect on the Company, was introduced by Mr. Cohen while talking on this particular point. In Australia, the people are so intensely patriotic that they have almost universally signed an undertaking not to buy anything which emanates from Germany, owing to the slanders on the British Army. As is a well known fact, many incandescent accessories come from Germany; and so the Company have now to procure from this country, as far as possible, the supplies of goods in which they deal. But, as previously stated, the whole of the mantles are made in Australia, and are protected accordingly.

Mentioning this, reminded Mr. Cohen of a point on which he feels very sore, and naturally so. The conditions under which Antipodean labor has been recently placed are, in his opinion, arbitrary in the extreme, both for the best of the workers and the employers. For example, a law came into force in New Zealand some 6 weeks ago that female workers (of whom many are employed in incandescent mantle making), should receive wages, standardized by Government, according to the age of the workers. The Company have certain girls in their factory who have been paid according to their merits, but who have not been paid according to the Government standard. As the law now stands, the Company have had to give these girls a retrospective 6 weeks' deficiency—that is, their wages have had to be made up to the standard as from the passing of the Act. This certainly appears to be a very arbitrary and vexatious law. Then, again, the 8-hour working day is general; and overtime is strictly prohibited, under any circumstances whatever. Inspections are rigorously carried out to see that the law is complied with. In Mr. Cohen's opinion, all this binding of labor and employers is demoralizing and unnecessary. It kills all incentive to the exercise of skill as between man and man; and it does not give to superior and earnest workers any advantage over those who are not so industrious or skilled. However, Mr. Cohen is hopeful that time will right this state of things.

What Improvement is Desired in Electric Meters?[1]

By Mr. Robert Ferris.

Considering the improvements in meters during the last few years, it may be reasonable to expect still further improvements along this line. Perhaps the greatest improvement would be that which would eliminate the possibility of a meter being stopped when it should be in motion. The success of a meter depends largely upon the friction of all moving parts being reduced to a minimum. Anything that would replace to advantage the pivot and jewel, without sacrifice, would be an improvement; for if we can keep a meter in motion, it should be easy enough to keep it in calibration.

The efficiency of meters is something of importance, yet a meter should have plenty of torque. While it is possible to save considerable by having efficient meters, it is also possible to lose considerably more by having meters that will not stand up on light loads.

Durability, then, is another consideration, which, with reference to meters, means that a meter can be put in service and remain there without additional cost, whether in the shape of attention, repairs or loss of revenue.

Credit should be given to the engineering forces of the manufacturers of meters, for they have given us what we have. They may be accused of developing the idea of some fellow who in an unguarded moment let some salesman "in on it," but even at that they should have credit for the development. If any of us have ideas that lean toward improvements, we should be willing to see them developed if we can find anyone that will spend his money to do it.

It is rather hard to say just what improvement is most desired in meters, for we find ourselves pitted against the engineering forces of all the manufacturers, and it is known that there are many who are trying to make a living trying to produce that improvement. A few suggestions might be made that would at least furnish something for the engineers to work on, and after submitting mine I should be glad if I could know that I was forgiven. They are: A universal meter in size and style; a backboard for meters, of a standard pattern which could be adapted to meters of any make on the market; a registering dial that would read directly in dollars and cents, or if not that, then the adoption as a standard of direct reading dials and a simple telltale hand on clock for calibrating purposes; a meter that would take the place of the combination of watt and discount meters, having the effect of registering at different rates of speed, which would be governed by the load that was passing. To illustrate: If we had, say, a 100-volt wattmeter of 25-ampere capacity, instead of showing a straight line from 5 per cent. of its capacity to full load, the meter speed would represent at full load accurate registering, and as the load dropped the proportional rate of registering would be a certain per cent. slow or fast.

If it were wanted to increase the hours of lighting on a 24-hour service, the first method would apply; and in the stations where only night service is given and it is wanted to increase the quantity of lighting for short hours, the latter would apply. Of course, the reading would not show the actual watt hours consumed, but that need not be a serious objection. The reading could be called units and the price would be so much per unit, and instead of discounting bills, we should find that the meter had already taken care of that.

1. Joint paper read before the Cincinnati Convention of the National Electric Light Association.

By Mr. Clifford A. White.

From a commercial point of view, the following considerations regarding electric meters appeal to me in my capacity as cashier of an electric company:

The electric lighting business is full of mysteries to the general public with whom it has to deal, and, consequently, anything not easily understood arouses suspicion immediately. Therefore, anything that concerns the public should be as simple as possible.

The meter dial should read direct in kilowatt hours, thereby eliminating the use of the constant and the use of two terms kilowatt hour and watt hour; there should also be a hand on the dial for testing purposes.

The term kilowatt hour is not easily explained understandingly, but as this is the most appropriate and generally accepted unit of electrical energy, it would be highly impracticable to adopt any other term, and the public must be educated to its meaning.

Nearly all meters now in use register in watt hours, thus making necessary the use of two terms, which is confusing to the uninitiated. The average price for current is 20 cents per kilowatt hour, which will continually grow less rather than more; therefore, the kilowatt hour should be the unit to use, as by adopting the rule of reading in every case the figures the hand has passed on the unit dial, the error in reading would never amount to more than 10 cents to the customer, and the total sales of the company would not be affected at all. The new meters now being placed on the market register in watt hours, which is a great improvement over those that required the use of a constant; but a direct reading dial should be designed to replace those now in service having constants. This does not seem a mechanical impossibility, and if the cost were reasonable it would be generally adopted. The constant has always been a perpetual source of annoyance and error. Its use makes a great deal more work in the bookkeeping department, and complicates the rendering of bills correctly, consequently creating a continual and unnecessary expense to the office. It is next to impossible to make the average customer understand its meaning, and it should be returned to the laboratory whence it originated, never to be resurrected.

Testing should be done at the dial rather than at the disk; for while the chance for error between these two points is slight, by making the test at the dial that chance is reduced to a minimum.

The business is every year becoming more complicated, and any suggestions that tend to simplify matters should receive the attention of station managers and manufacturers alike, especially those that directly concern the public, for the simpler and more easily understood such matters are, the better satisfied the public is, and satisfaction brings more business.

Massachusetts Electrical Systems in 1901.—Finances.

By Mr. Alton D. Adams, in *Electrical World.*

Electric lighting companies in Massachusetts, doing only an electrical business, had issued capital stock to the par value of $12,764,351.62 on June 30, 1901. This amount is greater by 8.5 per cent. than the capital of these companies on June 30, 1900. At the close of the fiscal year first named the bonds of these companies outstanding amounted to $3,615,100, and the notes payable to $2,965,662.75. These figures show a decline during the year of 6.2 per cent. in the amount of bonds, but an increase of 46.9 per cent. in the notes payable.

At the close of the fiscal year under consideration all the gas companies of the State had outstanding $18,796,500 in stocks, $2,168,250 in bonds, and notes payable to the total of $5,456,382.01. Measured by issues of stocks, bonds and notes, the investments of the gas are thus greater than those of the purely electric companies, but 13 of the gas companies in cities and 9 of these companies in towns operate electric as well as gas plants. It is not possible to state just how much of the investment of the gas companies is represented in their electric plants.

The surplus of the purely electric companies was $2,735,270.74 at the date first mentioned, an increase of 22.3 per cent. over the surplus for

the previous year. The surplus just named for 1901 was 21.4 per cent. of the capital of the electric companies.

All of the central electric lighting stations in the State, by whomsoever operated, earned an income of $6,217,804 during the year of 1901, and this amount exceeded that for the previous year by 9.5 per cent. Of this income 99 per cent. was from sales of electrical energy, and the remaining 1 per cent. from the rent of meters and motors and from steam heating. The income from sales of electrical energy, amounting to $6,159,205.59, was made up of 8.8 per cent. from service to commercial arc lamps, 3.5 per cent. from commercial incandescent lamps operated at contract rates, 44 per cent. from incandescent lamps at meter rates, 22.9 per cent. from public arc lamps, 5.7 per cent. from public incandescent lamps, and 14.9 per cent. from electric power. It thus appears that 28.6 per cent. of the energy income was from public and 71.4 per cent. from private service. The income from electric street lamps amounted to $1,764,176.77.

In this same year the total sales of gas amounted to $7,057,858.52, and only $172,825.75 of this sum was derived from gas street lamps. It thus appears that the income from sales of electrical energy was 87.2 per cent. of that from gas, but that gas street lamps yielded only 9.8 per cent. as much income as electric street lamps.

During the fiscal year of 1901 the total expenses of all electric lighting systems were $3,922,403.08, or 63 per cent. of the gross income. These expenses were greater by 10.6 per cent. than the amount for the previous year. Of the total cost of operation, 49.1 per cent. was expended at the stations, 24.1 per cent. in distribution, 13.0 per cent. for office expenses and management, and 13.6 per cent. for miscellaneous expenses. The expenses of operation at the stations amounted to $1,929,605.43. Of this sum 48.4 per cent., or $934,448.20, went for fuel. The percentage of this fuel item was 23.8 compared with the entire expenses of the electric systems, showing that efficiency of operation might be increased with marked advantage.

Other expenses at electric stations were: For rent of real estate, 3.2; oil and waste, 2.2; water, 3.0; wages, 28.2; repairs of station, 2.2; steam plant repairs, 6.7; electric plant repairs, 5.0, and appliances, 0.6 per cent. of the total cost of operation there. When the total expenses are deducted from the entire earnings of operation of electric systems, as just given, there remains a net profit of $2,295,401.74 for the year. Of this amount the electric stations operated by gas companies earned $342,056.17, so that there remains the sum of $1,953,345.57 as net profits for the purely electric companies. In addition to earnings previously stated, these electric companies received $356,302.02 from rents, jobbing and other sources, which, added to the sum last found, gives a total net profit of $2,309,647.59 for the electric companies. From this sum there was deducted $314,502.49 for the payment of interest and $464,269.06 for sundry other items, leaving $1,530,378.53 that might be devoted to either depreciation, surplus or dividends, at the election of the companies.

This $1,530,378.53 equals 11.9 per cent. on the $12,764,351 of capital stock issued by the electric companies. As a matter of fact, the sum of $1,006,350.57 was paid in dividends, leaving $524,027.96 for surplus and depreciation charges.

On June 30, 1901, the electric lighting stations of Massachusetts contained 928 dynamos, including 114 power generators. The total capacity of these dynamos amounted to 69,434 kilowatts, of which 12,234 kilowatts were in arc and 43,097 kilowatts in incandescent dyuamos, and 14,103 kilowatts in power generators. The average capacity was 74 kilowatts each. From these figures it appears that the power generators represented 20 per cent., the arc dynamos 17 per cent., and the incandescent dynamos 62 per cent. of the total station capacity.

The increase of capacity for all dynamos during the year was only 493 kilowatts, the smallest amount added in any year since 1883. Only the incandescent dynamos gained in capacity during the year, and their increase amounted to 1,384 kilowatts. Meantime the arc dynamos lost 439 and the power generators 452 kilowatts of capacity.

The decrease in capacity of arc dynamos began in 1900, and is no doubt due to the substitution of service from incandescent or constant pressure machines, particularly by the use of constant current transformers. Decline in capacity of power generators seems to be due to the removal of such machines from electric lighting stations, where they have been employed to supply power for street car motors, to separate street railway plants.

At the close of the year under consideration the steam engines in electric lighting stations numbered 344, so that there were 2.7 dynamos to every engine on an average. These 344 engines had a combined capacity of 89,348-horse power, and the average capacity was 260-horse power each. The capacity of all dynamos in electric lighting stations, reduced to horse power, is 93,075, so that the ratio of dynamo to engine capacity was 104.1 per cent.

Besides the engines, electric lighting stations contained 42 water wheels, with an aggregate capacity of 9,432-horse power, or 224.5-horse power each on an average.

The combined rating of steam engines and water wheels in electric lighting stations was 98,780-horse power, and of this capacity the water wheels represented 9.6 per cent. These stations contained 359 steam boilers, with a total rating of 60,323-horse power at the close of the year. The average rating of these boilers was thus 168-horse power each. It may be noted that the number of boilers exceeds that of engines by 4 per cent., but the engine rating is greater than that of boilers by 48 per cent. Evidently there is less tendency to large sizes in boilers than in engines. As a boiler horse power is usually based on the delivery of 30 pounds of steam per hour, while an engine should consume steam at a less rate, the boilers may have been able to operate all the engines.

There were 7,967 electric motors connected to the circuits of lighting stations at the close of the fiscal year under consideration. Of these motors 5 were on circuits operated by arc dynamos, 5,230 were on incandescent circuits, and 2,732 motors were supplied from electric power generators. Fan motors are not included by these figures. The increase in the number of motors during the year was 1,649, and this number was made up by the addition of 160 motors to power circuits, 1,495 to incandescent circuits, and the loss of 6 motors from arc circuits. The 7,967 motors had a combined capacity of 31,426-horse power, corresponding to an average of 3.9-horse power each. The number of motors on power circuits was 34 per cent., and that on incandescent circuits 65 per cent. of the total. Motors added to the service of lighting stations during the year had a total capacity of 4,293-horse power, an increase greater than that in any other year, except that of 1900, in the history of the State.

Of the combined capacity of all the motors in Massachusetts on the circuits of lighting stations Boston had 56 per cent. in 1901. The number of these motors for Boston was 4,793, and their total capacity 17,785-horse power. These motors were made up of 5 on arc circuits, 1,086 on power circuits, and 3,702 on incandescent lines. For all these motors the average horse power was 3.7. During the year 1,279 motors were added to the circuits of lighting stations in Boston, and the capacity of these motors was 2,826-horse power, or 2.2-horse power each on an average. This increase in the number and capacity of motors at Boston was greater than that of any previous year.

Electric lighting systems included among their equipment 25,779 arc lamps throughout the State in the year under consideration. Of these lamps 2,280 were single open arcs, 7,787 were double open arcs, and 15,712 were inclosed arcs. During the year the number of single open arcs declined by 635 and the number of double open arcs by 665, but the number of inclosed arcs went up by 3,724. The net result of these changes was a gain of 2,424 in the total number of lamps. The most notable feature of this showing is the rapid conquest of the field by inclosed arcs. Circuits of lighting stations were supplying 11,219 commercial arcs and 14,080 arc street lamps at the close of the year, a total of 25,299 lamps. The difference between this total and that previously given for all arc lamps of lighting systems seems to be due to the fact that all arc lamps owned by lighting stations are not in constant use. Arc street lamps formed 55 per cent. of the total number of street and commercial arcs.

Commercial arc lamps increased in number by 1,417 and street arcs by 618 during the year. In Boston the total number of arc lamps was 8,434, or about ½ of that for the entire State. Of these lamps 303 were single open arcs, 308 were double open arcs, and 7,823 were inclosed arcs. It follows that more than ½ of the inclosed arcs in the State are at Boston, where they have displaced nearly all of the other types.

Where the rating of arc lamps was given in candle power, the energy capacity of lamps has been computed on the basis of 0.25 watt per nominal candle power. In cases where lamps were rated in amperes, the figures for amperes have been multiplied by 80 to get the watt capacity per lamp. Results obtained in this way are not highly accurate, but probably involve no serious errors. The numbers of commercial arc lamps for each of the several ratings are as follows:

Candle Power.	Number Lamps.	Candle Power.	Number Lamps
800.....	6	1,400.....	105
1,000.....	9	1,600.....	61
900.....	9	1,800.....	2
1,200.....	2,004	2,000.....	4,314
1,300.	2	4,000.....	6

Ampere Rating.	Number Lamps.	Ampere Rating.	Number Lamps.
3.0	448	0.6	1,069
4.0	825	7.5	7
4.5	131	8.8	8
5.0	2,174	0.10	27
5.5	10	0.18	2

Of the total number of commercial arc lamps 18 per cent. were rated at 1,200-candle power, and 44 per cent were rated at 2,000 candle power each. Lamps with a rating of 4 amperes formed 7 per cent., lamps rated at 5 amperes 20 per cent., and lamps rated at 6 amperes 9 per cent. of the total number of commercial arcs.

The combined capacity of all commercial arc lamps at the close of the year was 4,672 kilowatts, on the basis already stated. Of this total 1,200 candle power lamps represented 13 per cent., and 2,000-candle power lamps 46 per cent. Lamps of 1,200-candle power represented 601 kilowatts, 2,000-candle power lamps 2,157 kilowatts, 5-ampere lamps 869 kilowatts, and 6-ampere arcs 513 kilowatts.

Arc street lamps were divided among the several ratings as follows:

Candle Power.	Number Lamps.	Ampere Rating.	Number Lamps.
1,200	6,509	5.5	6
1,500	2	6.0	325
1,600	20	6.6	122
2,000	7,089	7.5	1

Of the total number of arc street lamps those rated at 1,200-candle power formed 46 per cent., and those rated at 2,000-candle power were 50 per cent. The capacity of all arc street lamps was 5,732 kilowatts, and of this 1,952 kilowatts was in 1,200-candle power, and 3,544 kilowatts in 2,000-candle power arcs.

Commercial incandescent lamps connected to the circuits of lighting stations throughout the State numbered 1,117,707 at the close of the fiscal year. The number of these lamps of each candle power was as follows:

Candle Power.	Number of Lamps.	Candle Power.	Number of Lamps.
4	377	24	598
6	999	25	35
8	3,097	30	6
10	4,564	32	248
12	1,759	50	22
14	6	65	1
16	1,103,133	150	27
20	2,835		

Lamps of 16 nominal candle power far outnumbered all others, standing at 1,103,133. Next in importance come lamps of 8 and 10-candle power.

In this same year 18,301 incandescent street lamps were operated by the lighting stations of Massachusetts.

The numbers of these street lamps were distributed among the different candle powers as follows:

Candle Power.	Number of Lamps.	Candle Power.	Number of Lamps.
15	219	32	1,482
16	169	40	530
20	861	50	23
24	168	64	9
25	14,001	65	17
30	821	75	1

Of all the incandescent street lamps 14,001, or 76 per cent., were of 25 nominal candle power. The size of next importance is the 32-candle power with 1,482 lamps.

Allowing 3.5 watts per nominal candle power, the 1,117,707 commercial incandescent lamps have a combined capacity of 62,419.5 kilowatts. Of this capacity the 16-candle power lamps alone represented 61,775.4 kilowatts, or 99 per cent. Making the same allowance per candle power, the 18,301 incandescent street lamps have a total capacity of 1,656.9 kilowatts. Of this total the 25-candle power street lamps represent a capacity of 1,225 kilowatts, or 74 per cent. Adding the figures for incandescent lamps in street lighting and commercial service, their total capacity amounts to 64,076.4 kilowatts. The 62,419.5 kilowatts of commercial incandescent lamps represent 97 per cent. of this total capacity.

At the end of the fiscal year electric lighting systems had 105,601 poles set in streets throughout the State, and 4,440 poles set on other property, a total of 110,041 poles. With 50 poles per mile, this number of poles would suffice for 2,200 miles of pole line.

At the same date the electric lighting systems included 1,128,907 feet, or 214 miles, of underground conduit. It thus seems probable that the length of underground conduits was about one-tenth that of pole lines. The total length of wire in underground conduits was 8,177,364 feet, so that each conduit carried 7.2 wires on an average. Assuming an efficiency of 74.6 per cent. for all electric motors, their total capacity in kilowatts is represented by the number previously given for their horse power capacity. The capacities of the several elements of the connected load of lighting stations are combined to determine their total capacity:

Arc street lamps	5,732	kilowatts.
Incandescent street lamps	1,656	"
Commercial incandescent lamps	62.419	"
Commercial arc lamps	4,672	"
Electric motors	31,426	"
Total connected load	105,985	kilowatts.

Dividing the income of $1,410,812.06, derived from arc street lamps, by the number representing the kilowatt capacity of these lamps, shows the income per kilowatt of their capacity to have been $246. Incandescent street lamps earned $353,364.71 during the year, or $213 per kilowatt of connected capacity. Income from commercial incandescent lamps amounted to $2,927,774.03 during the year, and this sum corresponds to $45 per kilowatt of their connected capacity. The earnings of commercial arc lamps were $545,468.75, and the average income per kilowatt of their capacity was therefore $117. Service to electric motors brought $921,786.04 to lighting stations, or $29 per kilowatt of motor capacity. Considering the entire connected load, the income was $58 per kilowatt. Public lighting yields a larger rate of income than private service per kilowatt capacity of connected lamps, in part, because street lamps are operated more hours per year than are private lamps.

Of the 105,905-kilowatt capacity of lamps and motors connected to lighting systems the percentage in arc street lamps was 5.4, in incandescent street lamps 1.6, in commercial incandescent lamps 59, in commercial arc lamps 4.4, and in electric motors 29.7.

As the total capacity of dynamos in lighting stations was found to be 69,434 kilowatts at the close of the year in question, the connected load of 105,905 kilowatts in lamps and motors was 1.52 times this dynamo capacity.

Some Averages of Electric Light Costs and Charges.

The *Electrical Review* notes that the subject of the cost of fuel and the other necessities for the production of electric light, and the charges made for electrical supply by plants in various parts of the country, is one that appears not to have received any great amount of attention or investigation. Recently the *Electrical Review* sent out a large number of inquiries to representative electric light stations in all the States of the United States requesting information concerning:

1. The price of coal.
2. Whether or not water power is used in the production of electric current.
3. Whether current is sold on the meter or contract basis.
4. The base rate of charges per kilowatt hour and the minimum rate of charge per kilowatt hour for large customers.

Responses to these inquiries have been received from a sufficient number of stations to permit the preparation of averages which are believed to be fairly accurate and representative. The stations represented in these averages are situated in all parts of the United States from Maine to California, and from Florida to Oregon. On account of the private nature of some of the figures given it is not possible to give the names of the stations represented in these averages, but all of them are representative stations of average size, operated as nearly as could be determined upon the lines of good average practice. The results are of great interest.

1. Concerning the price of fuel: The highest price paid for coal by the stations replying is $6 per ton, and the lowest price $1 per ton, the latter representing slack coal, and the former "run of mine." The average price of coal paid by stations representing all but a few States is $2.96 per ton, delivered at the plants.

2. Concerning water power: Twenty per cent. of the stations listed use water power either wholly or in part for power production.

3. Basis of sale of power: Nine per cent. of the stations adhere to the old contract basis. Four per cent. use both the contract and the meter basis, while 87 per cent. use the meter basis entirely and exclusively in determining their charges for current supply.

4. The basis of charge: This is in many respects the most interesting

of the figures obtained. The highest basic rate of charge made anywhere is 20 cents per kilowatt hour, this rate being confined to a few stations in the eastern States. The lowest minimum rate charged is 1 cent per kilowatt hour, this rate referring to a water power plant operated in connection with a long transmission line and supplying customers with power for general purposes, including street railways. The average base charge per kilowatt hour through the United States is 12.3 cents, while the average minimum charge to large consumers is 5.1 cents.

If we might assume that the price of fuel is a fair indication of a reasonable basis of charge, it will be seen that the rate per kilowatt hour figures out at about 4 per cent. of the cost of a ton of coal. In other words, the average efficiency of conversion of coal into power is at the rate of 1 ton for 20 kilowatt hours sold. On the same basis, the average minimum is 1.7 of the cost of coal, representing an apparent maximum efficiency of conversion of 1 ton of coal into 59 kilowatt hours. This assumption, however, does not seem to be entirely warranted, since an examination of the data received shows that there is very little apparent connection between the price paid for fuel and the amount charged for power. For example, a station paying $5 for coal has a basis rate of 10 cents with a minimum of 2 cents; whereas another station paying only $1 for coal has a basis rate of 15 cents and a minimum charge of 5 cents. Perhaps all that may be definitely claimed, as shown by these figures, is that other elements than the cost of fuel are the determining factors in the output cost of electric current, or else that the subject has never received that scientific investigation which is its due.

In the United States we are in a position curiously contrasted with that in which English central stations find themselves. In that country a legal requirement forces the publication of the figures of cost and charge, the former being analyzed very carefully for all public supply plants. The most immediate result of this publicity has been the close and accurate study of the costs of electric supply and the understanding on the part of station managers and the shareholders in such enterprises of the various elements entering this business. A large part of the stations in that country are earning satisfactory dividends upon the investment they represent.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Mr. Frederic Egner Explains.

MORRISTOWN, N. J., June 3d, 1902.

To the Editors AMERICAN GAS LIGHT JOURNAL: In the report of the Library Committee of the Western Gas Association, as published on page 801, JOURNAL of the 2d inst., Mr. Shelton refers in rather ambiguous terms to "Mr. Frederic Egner." As the JOURNAL is the official organ of the Association, and the writer, by reason of the unexpected delay of a train, was late in attending the meeting, permit me to say a few words about that report, as far as it relates to the subscriber and his connection with the gas literature indexing matter.

When informed by Mr. Shelton, in August last, that I had been selected to prepare an index of gas literature for the Western Association, I felt deeply grateful for this mark of esteem on the part of my fellow members, and the committee in particular. The writer, however, was not then informed that Mr. Shelton had mapped out a plan of his own for doing the work mentioned, but was told only that the matter still depended upon a sufficient amount being raised to take up the work. It was not until February of this year, when Mr. Shelton and the writer had a meeting, that the former disclosed *his* plan and method, which were to be carried out in doing the work. The writer was willing to do the work without compensation, if need be, though that was not asked, but he was not prepared to do it—and could not do it—at what seemed, up to the date of his informing the committee of his withdrawing, a certain and considerable loss. According to the only information the writer could obtain, as late as March 14th of this year, the annual subscriptions to the fund amounted to but $630, while the annual expenses for cards, printing, file cases, expressage and mailing came to over $1,500, if the plan, as disclosed by Mr. Shelton to me, was carried out. If the subscription was greater than the sum named the writer knows not, as he was not informed that such was the case at the time of his withdrawal. He was informed, however, that the committee had someone else in view if he could not go on with the work.

The estimate of cost and expense was based upon figures obtained from two responsible and well-known firms, who make a specialty of such work, and the figures were submitted by the writer to Mr. Shelton, who, however, never acknowledged them. The writer has at all times shown his willingness to do his full share of the Association work, in which claim the published proceedings alone will bear him out, and it seemed to me that the Library Committee had done very well indeed in getting along as far as they had, and that there was no need to try to make a "scapegoat" of anybody. Had the report of the committee been made according to the published programme—viz., on Thursday, May 22d, instead of being rushed through before noon of May 21st, I would have been present to answer in person, instead of now most unwillingly rushing into print. Meanwhile, if anyone desires to go further into this question I am quite ready to do so. Very respectfully,

FREDERIC EGNER.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE City Council of Chicago recently passed an order directing the judiciary committee of that body, requiring all gas companies doing business within the city limits to file with the building department all rules and regulations respecting the piping of buildings.

IT is declared that Messrs. A. N. Brady, Hugh J. Grant and their associates have acquired a controlling interest in the properties of the Kings County Gas and Illuminating Company. Its plant is located at the foot of West 55th street, Brooklyn, and its main field of business is the section locally known as New Utrecht. It is a valuable piece of property, and the wonder is that it was not taken over by the Brooklyn Union Company.

THE Keystone Meter Company, of Royersford, Pa., informs us that it has just installed a huge stamping press. The machine is equal to giving an 80-ton stroke.

THE proprietors of the Ionia (Mich.) Gas Light and Coke Company have put into commission their new coal gas plant, the work in connection with which was performed by the Lloyd Construction Company, Detroit, Mich.

A RATHER breezy suggestion was that recently made by Councilman McFarland, of Indianapolis, Ind., who thinks that a vote of consumers of natural gas should be taken next month. He declares that the consumers could easily show their sentiments by voting, when they pay their gas bills, as to whether or not they want meters, and if so, at what rate they would consider gas per 1,000 sold by meter, reasonable. So, Mr. McFarland!

IT is said that Joseph J. Heim, and associates, have applied to the Common Council for the right to construct and operate a gas works in Kansas City, Mo. The coterie propose to sell gas for all purposes at the rate of 50 cents per 1,000 cubic feet. It is not likely that anything will result from the application.

MR. FREDERICK S. FAILING, for some years in the employ of the Peoples Gas and Electric Company, of Oswego, N. Y., has accepted a responsible position with the Syracuse (N. Y.) Gas Light Company.

MR. JOHN F. CONNOR, of Mount Morris, N. Y., has been appointed Referee in the action of the Bank of Le Roy, N. Y., against the Le Roy Gas Company.

THE Portsmouth (N. H.) Gas Company will extend its mains to the adjoining territory of Christian Shore.

AT a meeting of the Board of Directors of the Lowell (Mass.) Gas Light Company, held on the 27th ult., it was unanimously voted that Mr. Thos. H. Hintze be appointed Superintendent of the Company. A further vote was also passed appointing Mr. George W. Farnham Consulting Superintendent of the Company. A little more than two years ago Mr. Farnham sustained a partial stroke of paralysis, and in order to lighten the burden that he has so faithfully carried for many years the above official changes were made. In early November next Mr. Farnham will have completed 50 years of active service in the employ of the Lowell Company.

A CORRESRONDENT forwards the following from Hyde Park, under date of the 6th inst: "Users of gas in Hyde Park, a suburb of Chicago, have not lost their fight for 72-cent fuel gas, providing they take advantage of a 20 per cent. discount. When the case came before Judge Dunne, on June 18 of last year, in the form of a final hearing on a temporary

injunction, the bill was dismissed for want of equity. Yesterday the Appellate Court, in an opinion written by Judge Adams, held that Judge Dunne erred in dismissing the bill and reversed the decree entered by him in so doing. The case will now go to a final hearing on its merits, and the camplainants will be allowed to prove their allegation that the Peoples Gas Company should be restrained from charging more than 72 cents per 1,000 cubic feet for fuel gas. In addition to the Hyde Park case, the Peoples Gas Company has another fight on hand in connection with the city of Chicago's 75-cent gas ordinance. Last January Judge Grosscup refused to enjoin an enforcement of the 75-cent ordinance because it had not been proved that the ordinance fixed an unreasonable price on gas. The Company will make a second attack on the ordinance in the United States Circuit Court to-day, with arguments on an amended bill for an injunction filed yesterday afternoon. The Company has retained former United States Attorney Gen. Griggs as special counsel, and he will appear before Judge Grosscup this morning. Other attorneys on the Company's side will be James F. Meagher, former Judge Thomas A. Moran and W. F. Sheehan, of New York. Granville W. Browning and several assistants of Corporation Counsel Walker will appear for the city."

AT a special election recently held in Norwich, Conn., a vote was cast as to whether or not it would be good policy to have the city operate the local gas and electric lighting plants on municipal account. The result of the ballot was: In favor, 1,956. opposed, 340.

THE proprietors of the Logan Gas and Fuel Company have applied to the authorities of Sandusky, O., for an ordinance permitting them to supply natural gas in that city, at a rate not to exceed 50 cents per 1,000 cubic feet.

AT the annual meeting of the shareholders in the Gas and Electric Company, of Bergen county, N. J., the following Directors were elected: Wm. McKenzie, David St. John, W. N. Coler, John C. Eisele, John J. Phelps, Lemuel Lozier, Addison Ely, Wm, M. Laws, D. A. Currie, F. A. E. Colt, E. A. Pearce, A. Jaretzki, R. W. Jones, Jr., D. A. Pell and Isaac Bogert.

AT the annual meeting of the Pottstown (Pa.) Gas and Water Company the following officers were elected: Directors, J. B. Lessig, M. S. Longaker, Wm. Auchenback, Calvin Fegley, Jno. W. Storb and Peter L. Egolf; President, J. B. Lessig; Secretary and Treasurer, J. H. Maxwell.

IT is reported that Messrs. C. W. Morse and John Cashman, of Haverhill, Mass., who are largely interested in the affairs of the Amesbury and Salisbury (Mass.) Gas Company, have purchased the properties and franchise of the Marlboro (Mass.) Gas Company.

THE New England Gas and Coke Company has defaulted on the interest on its bonds.

"T. L. S.," WRITING from Portland, Ore., under date of the 6th inst., incloses the following: "Owing to great increase in business the past 3 years, the cost of manufacture has been lessened and the Portland Gas Company is thereby enabled to make a reduction to its patrons. On August 1 the Company will reduce the price of gas to $1.50 per 1,000 feet, a reduction of about 20 per cent. on the present rate for lighting, and a reduction in the charge for gas for fuel of about 10 per cent. which will make the cost the same for both. The greatly increased consumption of gas during the last 3 years, the Company feels, will justify it in making this reduction. It has always been the policy of the Company to reduce the price of gas as fast as it possibly could, and the increase in its business of late, both in the matter of lighting and heating, has been so large that it feels the time has arrived when it can make another reduction, with the certainty of having the loss in receipts made up by an increased demand for its product. It has been the idea and the policy of the directors of the Company to anticipate any clamor for a reduction of this character. They are doing business here under a franchise from the public, and feel that the public is entitled to share in the prosperity arising from decreased cost of manufacture on account of increased consumption. The Company has its money invested here permanently, and a fair rate of interest is all it feels it is justly entitled to or should expect. The Company is increasing its facilities for distribution of gas by doubling its holder capacity and making great extensions of mains on both sides of the river, and is connecting houses at the rate of about 100 per month, not only new houses, but also old ones which were not piped in the former days of high prices for gas. The increase in the quantity of gas sold for fuel has been very marked of late, and it now amounts to about 30 per cent. of the entire output. This is the third reduction the Company has made during the last 10 years, and it simply depends upon the future increase of its business for a still further reduction in rates. It will be well for people building houses, even at some distance from the mains of the Company, to have them piped for gas, as it is only a question of a short time before they will all be reached."

IT is reported that all the properties of the St. Cloud (Minn.) Gas and Electric Company have been purchased by Messrs. James Mitchell, of West Newton, Mass., and A. W. Chester, of Westerly, R. I.

IT is again asserted, and with much positiveness, that a deal is being arranged between the Consolidated Gas Company, of Baltimore, and the United Electric Light and Power Company, of Baltimore. The latter concern is credited with owning 20,000 shares of the former's stock. The former holdings of Messrs. Henry R. Wilson and Frank Tilford, of New York, were taken over by the Power Company.

A CORRESPONDENT forwards the following from Nanaimo, B. C.: "The annual meeting of the Nanaimo Gas Company was held the 31st ult. The reports of the Secretary and Auditor showed that the Company had done considerable work in extension and maintenance of the works during the past year. The introduction of the new and improved gas lamps by the Company, as well as the introduction of a number of gas engines, which are coming fast in favor, materially increased the consumption of gas. The Directors elected for the year were: Dr. G. L. Milne, A. R. Johnston, Thomas Shotbolt, W. R. Bryant and Morgan Harris. A resolution of condolence was passed by the shareholders to the family of the late Mr. George Norris, who was for many years a Director of the Company. At a subsequent meeting of the Directors, Dr. G. L. Milne was made President; A. R. Johnston, Vice-President; W. K. Leighton, Secretary and Treasurer; Fred. G. Peto, Auditor."

THE Chicago *Tribune* of recent date said: "The gas interests of the Calumet Gas and Electric Company have been sold to parties friendly to the Peoples Gas Light and Coke Company. The electric business of the Calumet Company is retained. The Calumet Company was chartered a few months ago under the laws of Illinois. The backers were Rufus Dawes, C. G. Dawes, John R. Walsh and others. The Company secured a franchise for furnishing gas in Blue Island, and acquired gas and electric light privileges in Harvey. The Blue Island gas franchise was secured in opposition to an application by the Peoples Gas Light and Coke Company. It is not understood that the Calumet Company was organized for the purpose of selling out to the Peoples gas interests. The contrary notion seems to have been in mind. But the sale of gas franchises and interests indicates the fixed purpose and determination on the part of the Peoples Company to control the gas business in Cook county. The Peoples has been a persistent purchaser of gas companies in the last 10 years. Within that time there may be enumerated purchases of the Mutual Fuel Gas Company, Universal Gas Company, both operating in Hyde Park; the Calumet Gas Company, operating in the Town of Lake; the Evanston Gas Company, the Cicero Gas Company, and latterly the gas companies of Harvey and Blue Island. These purchases by friendly interests indicate the ultimate rounding up of the several properties into one consolidated corporation. The Calumet Gas and Electric Company will proceed with its electric business. It will probably have stations at Chicago Heights and Morgan Park, as well as Blue Island and Harvey."

THE Canadian Government has prescribed new regulations for the disposal of coal lands in Manitoba, the Territories and British Columbia. They provide that lands containing anthracite coal may be sold at an upset price of $20 per acre, and coal, other than anthracite, at an upset price of $10 per acre, or, if the Minister of the Interior so decides, may be sold by public competition. A royalty at the rate of 10 cents per ton of 2,000 pounds will be collected on the output of the mine, and the operator must furnish the Government with sworn returns accounting for the full quantity of coal mined. Not more than 320 acres can be sold to one applicant. Payment for the land in cash or scrip is to be made when the application is granted, or payment may be made of one-quarter of the purchase price only, and the balance in 3 equal annual installments, with interest at the rate of 5 per cent. upon the unpaid balance. Permission may be given to prospect for minerals upon land patented or entered, on which the coal mining rights have been reserved, upon payment of a fee of $10, and undertaking to recompense the owner or occupant of the soil for damages that may be done to his land.

The Market for Gas Securities.

The market for city gas shares continues dull and restricted, but the trading for the week was done at figures well in advance of those reported at last time of writing. Consolidated closed today (Friday) at 221 to 222, and the pessimists of last week, regarding the likely trend of values, now appear as optimists. It is true, however, that well posted operators for investment account still hold to the view that lower values are to prevail.

Brooklyn Union does not often appear in the actual sales' lists, and the ruling quotation (232 to 238) is strictly a nominal one. It appears that the Brady-Grant operators are the ones who have secured control of the Kings County Gas and Illuminating Company. Peoples, of Chicago, moved up 2 points in the week, on buying by very strong interests. Consolidated, of Baltimore, is strong. Rumor has it that the controllers of the electric lighting supply of that city are anxious to capture the gas supply, too. It would be to their great advantage, rather than that of the Gas Company. Detroit gas has been quite active of late, at prices something under 77. It is cheap at that. The general market is steady.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 Wall Street, New York City.

June 16.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$78,177,000	100	221	222
Central Union, Bonds, 5's.	3,000,000	1,000	109	110
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	350	..
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. Bonds, 5's	11,000,000	1,000	111½	..
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	109	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	..
Standard	5,000,000	100	130	140
Preferred	5,000,000	100	150	160
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	232	238
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	1⅝	1¾
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	13	13¼
" " Bonds, 5's	5,250,000	1,000	83½	84½
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	104½	104¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	108	109
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89¼
Preferred	3,026,500	100	106¾	107¾
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	68	68¼
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	14	17
" Con. Mtg. 5's	380,000	1,000	85	87
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	382,000	1,000	77	79
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	.	.
" Bonds	2,000,000	..	58	63
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	75	80
" Bonds, 6's	2 650,000	..	102	104
Jackson Gas Co.	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	89
Preferred	2,500,000	100	..	110
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	58	64
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	109½
" 6 per cent. scrip, due 1910	100,000	25	25	87
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	102	102½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	48	48½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	95	96½

Advertisers' Index.

GAS ENGINEERS.

	Page
Wm. Henry White, New York City	907
Fred. Bredel, Milwaukee, Wis.	894
Geo. R. Rowland, New York City	894
The Western Gas Construction Co., Fort Wayne, Ind.	912
Humphreys & Glasgow, New York City	905
David Leavitt Hough, New York City	904
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	901
Baxter & Young, Detroit, Mich	904
United Gas Improvement Co., Phila., Pa	899
James T. Lynn, Detroit, Mich	904
A. E. Boardman, Brevard, N. C	904
The Jeffrey Manufacturing Co., Columbus, O.	902

GAS WORKS APPARATUS AND CONSTRUCTION.

Continental Iron Works, Brooklyn, N. Y.	906
Delly & Fowler, Phila., Pa	908
Kerr Murray Mfg. Co., Fort Wayne, Ind.	904
Stacey Mfg. Co., Cincinnati, Ohio	907
Bartlett, Hayward & Co., Baltimore, Md.	905
Davis and Farnum Mfg. Co., Waltham, Mass.	904
R. D. Wood & Co., Phila., Pa	908
Isbell-Porter Company, New York City	906
Fred. Bredel, Milwaukee, Wis.	894
United Gas Improvement Co., Phila., Pa	899
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	901
The Western Gas Construction Co., Fort Wayne, Ind.	912
Humphreys & Glasgow, New York City	905
Logan Iron Works, Brooklyn, N. Y.	903
Riter-Conley Mfg. Co., Pittsburgh, Pa.	907
Baxter & Young, Detroit, Mich.	904
G. Shepard Page's Sons, New York City	904
James T. Lynn, Detroit, Mich	904
A. E. Boardman, Brevard, N. C	904
Christopher Cunningham, Brooklyn, N. Y.	892
The Jeffrey Manufacturing Co., Columbus, O.	902
Quintard Iron Works, New York City	901
The Connersville Blower Company, Connersville, Ind.	909
Lloyd Construction Co., Detroit, Mich.	894
Connelly Iron Sponge and Governor Co., New York City	895

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md.	905
United Gas Improvement Co., Phila., Pa.	899
Burdett Loomis, Hartford, Conn.	906
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	901
The Western Gas Construction Co., Fort Wayne, Ind.	912
Humphreys & Glasgow, New York City	905
B. E. Chollar, St. Louis, Mo.	902

SCRUBBERS AND CONDENSERS.

R. D. Wood & Co., Phila., Pa.	906
Continental Iron Works, Brooklyn, N. Y.	906
Logan Iron Works, Brooklyn, N. Y.	908
Riter-Conley Mfg. Co., Pittsburgh, Pa.	907
The Western Gas Construction Co., Fort Wayne, Ind.	912

PRODUCER POWER PLANTS.

R. D. Wood & Co., Philadelphia, Pa.	906

TAR AND CARBONIC ACID EXTRACTOR.

The Western Gas Construction Co., Fort Wayne, Ind.	912

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich.	891
The Western Gas Construction Co., Fort Wayne, Ind.	912

GAS METERS.

John J. Griffin & Co., Phila., Pa.	872
American Meter Co., New York and Philadelphia	911
Helme & McIlhenny, Phila., Pa.	911
D. McDonald & Co., Albany, N.Y.	909
Nathaniel Tufts Meter Co., Boston, Mass.	910
Maryland Meter and Mfg. Co., Baltimore, Md.	910
Metric Metal Co., Erie, Pa	911
Keystone Meter Co., Royersford, Pa.	910
Detroit Meter Company, Detroit, Mich.	911

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia	911
John J. Griffin & Co., Phila., Pa.	872
D. McDonald & Co., Albany, N. Y.	909
Helme & McIlhenny, Phila., Pa.	904
Nathaniel Tufts Meter Co., Boston, Mass.	910
Keystone Meter Co., Royersford, Pa.	910

GAS AND WATER PIPES.

M. J. Drummond & Co., New York City	896
R. D. Wood & Co., Phila., Pa.	906
Warren Foundry and Machine Co., New York City	896
Donaldson Iron Co., Emaus, Pa.	896
Christopher Cunningham, Brooklyn, N. Y.	892
Charles Millar & Son Co., Utica, N. Y.	896

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N. Y. City	896

GAS TAPPING MACHINES.

George Light, Dayton, O.	896
H. Mueller Manufacturing Company, Decatur, Ills.	893

GAS COALS.

Perkins & Co., New York City	902
Westmoreland Coal Co., Phila., Pa.	901
Berwind-White Coal Mining Co., New York and Phila.	902

CANNEL COALS.

Perkins & Co., New York City	902

CONVEYORS.

The Link-Belt Machinery Co., Chicago, Ills.	903
The Western Gas Construction Co., Fort Wayne, Ind.	912
The Jeffrey Manufacturing Co., Columbus, O.	902
C. W. Hunt Company, New York City	891

GAS ENRICHERS.

Standard Oil Co., New York City	863
The Sun Oil Co., Pittsburgh, Pa.	903

COKE CRUSHERS.

C. M. Keller, Columbus, Ind.	903
The Jeffrey Manufacturing Co., Columbus, O.	902

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y.	901
The Connersville Blower Company, Connersville, Ind.	909

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N. Y.	893

GAS GAUGES.

The Bristol Co., Waterbury, Conn.	902

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City	895
Isbell-Porter Co., New York City	906
R. D. Wood & Co., Phila., Pa.	906

CEMENTS.

C. L. Gerould, Galesburg, Ills	900

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J.	900
Adam Weber Sons, New York City	900
Laclede Firebrick Mfg. Co., St. Louis, Mo.	900
Cyrus Borgner, Phila., Pa.	900
James Gardner, Jr., Co., Pittsburgh, Pa.	900
Henry Maurer & Son, New York City	900
Baltimore Retort and Firebrick Co., Baltimore, Md.	900
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.	900
Brooklyn Firebrick Works, Brooklyn, N. Y.	900
Missouri Firebrick Co., St. Louis, Mo.	900

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md.	905
Fred. Bredel, Milwaukee, Wis.	894
J. H. Gautier & Co., Jersey City, N. J.	900
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.	900
Adam Weber Sons, New York City	900
Laclede Firebrick Mfg. Co., St. Louis, Mo.	900
Missouri Firebrick Co., St. Louis, Mo.	900

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City	905
Continental Iron Works, Brooklyn, N.Y.	906
Logan Iron Works, Brooklyn, N. Y.	908
R. D. Wood & Co., Phila., Pa.	906
The Western Gas Construction Co., Fort Wayne, Ind.	912

(*Continued on page* 891.)

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., June 11, 1902

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 15th, 1902, to stockholders of record at the close of business, June 30, 1902. Checks will be mailed.

1410-5 LEWIS LILLIE, Treasurer.

GAS COOKING INSTRUCTOR,

Employed by large gas company as visiting teacher and inspector, will give Saturday evening hall or showroom talks within easy traveling distance of New York city. These talks are not on cooking illustrated by gas, but on gas illustrated by necessary cooking, by a specialist familiar with the structure, peculiar features and working capabilities of all leading gas ranges. Address, "COOKING TEACHER,"

1410-1 212 East 20th street, New York city.

WANTED,

The Management of a Coal or Water Gas Plant,

By a hustling and competent young man. References furnished.

Address, "X.,"

1410-1 Care this Journal.

Position Wanted

BY A PRACTICAL YOUNG MAN, 28 years of age, who has been in the gas business the greater part of his life. Understands manufacture and distribution. Can do anything required inside or outside of a gas works. Best of references.

Address, "ST. A.,"

1410-1 Care this Journal.

WANTED,

The Management of a Gas Plant

In a city of 25,000 to 50,000 inhabitants. Thoroughly up-to-date in the manufacture and distribution of gas and electricity. Fifteen years' experience. At present superintendent of one of the most progressive companies in the United States. Address, "C. C. C.,"

1410-2 Care this Journal.

POSITION WANTED AS MANAGER,

By a hustler for new business. Has experience in selling gas stoves; also in laying high and low pressure mains. Understands the manufacture of coal and water gas in detail. Experience in reconstruction of benches and water gas apparatus. Was superintendent of gas works for number of years. Now in charge of new business department of one of the largest gas companies in the Union. Will furnish all required references. Address, "G. L.," care this Journal.

1409-4

WANTED.

AN UP-TO-DATE MANAGER, of many years' experience in the gas business, desires to secure a connection with some good gas company, in a position of trust and responsibility, as soon as possible. Address,

1409-tf "EXPERIENCE," care this Journal.

Position Wanted

As Superintendent or Manager of Gas Company,

By an experienced and successful young man. References. Address, "E. P. W.,"

1409-2 Care this Journal.

WANTED,

WATER GAS SET,

7 feet to 8 feet 6 inches. Address, with full particulars and price, "GAS COMPANY,"

409-2 Care this Journal.

WANTED,

A Bright, Up-to-Date, Young Man,

Thoroughly conversant with the manufacture of water gas, to take charge of a gas plant in a growing city of 35,000 inhabitants. A first-class opportunity for the right man.

Address,

RAILWAYS AND LIGHT COMPANY, OF AMERICA,
1500 Continental Trust Building,

1407-tf Baltimore, Md.

FOR SALE,

Complete Set of Four Purifying Box s,

In good condition. Size, 9 feet by 11 feet 6 inches by 3 feet 4 inches. Boxes have 15-inch seal, 10-inch connections, and are complete, with center seal, carriage and hoist.

Address, "JOURNAL,"

1410-1 Care this Journal.

FOR SALE.

1,800 Gasoline Burners and Tanks, complete, for Street Lights.

Used very little. Good as new. Address,

POST OFFICE BOX, NO. 524,

1409-5 Providence, R. I.

FOR SALE.

The Taunton Gas Light Company, Taunton, Mass., have the following apparatus for sale:

Two Sections of Hydraulic Main, Wrought Iron; Stiness Pattern Patent Tar Take-off; Bridge and Standpipes, and Mouthpieces, with Self-sealing Lids for 7 Benches of 6's.
One Sinuous Friction Condenser.
One Walker Tar Extractor.
One Standard Scrubber.
Four Purifiers, 10 by 16, complete.
One 5-foot Station Meter.

1404-tf

FOR SALE.

Apparatus for Complete Water Gas Plant,

Consisting of 5-ft. cupolas; purifying boxes, with center seal; engine, boiler, blower and holder.

Address, "P. R. R.,"

1403-tf Care this Journal.

GAS ENGINES FOR SALE.

Having made a change in our plant, we offer for sale

THREE OTTO GAS ENGINES,

of 50-horse power each; also, one starter. All in good condition. For terms, apply to

WILLIMANTIC GAS AND ELECTRIC LIGHT CO.,

1405-5m Willimantic, Conn.

Gas Company for Sale

IN A SMALL OHIO TOWN.

These works are paying 8 per cent. on the selling price, and have continued to do so for several years. The business can be doubled by ordinary attention.

Apply to A. M. SUTHERLAND,
15 Wall street, New York.

1409-2

INVENTIONS FOR EUROPE.

Engineers of standing and acquaintance in Europe are desirous of securing the handling of some good inventions abroad. We want such as will justify the organization of companies. Liberal propositions for the right articles.

ZERBE & ZERBE, Engineers,

1345-tf 11 Broadway, New York.

IN THE MARKET.

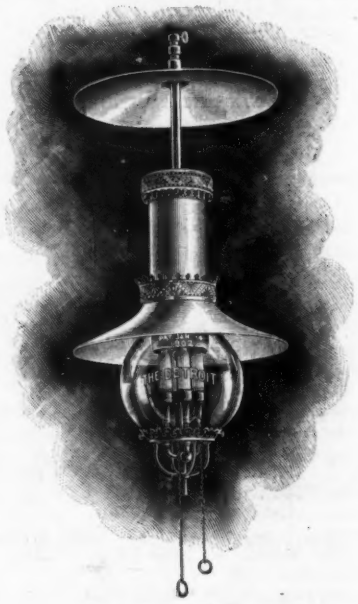
WE PURCHASE:

Gas properties,
Electric light properties.
Street railway properties.
Also desirable franchises.

W. R. FABEN CONSTRUCTION CO.,

1388-tf 817 St. Claire Street, Toledo, O.

The DETROIT



Force Draft

ARC GAS LAMP.

Durability,
Efficiency,
Simplicity,
Economy.

Perfect Combustion.
No Chimneys to Break.
No Matches Necessary.
Consumes Less Gas.
A Handsome Fixture.
Always in Order.

Our lamp gives 25 per cent. ***more light*** with 20 cent. ***less gas*** than any Arc Gas Lamp now on the market.

TO LIGHT CONSUMPTION WHAT THE GAS RANGE IS TO FUEL. : : : : :

SAMPLE ORDERS *Solicited.*

Manufactured by

The Detroit Arc Gas Light Co.,
67 to 71 Michigan Avenue,
DETROIT, MICH.

(*Concluded from page* 890.)

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 900

INCANDESCENT GAS LAMPS.

Welsbach Company, Gloucester, N.J..... 898
General Gas Light Company, Kalamazoo, Mich..... 893
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 891
Detroit Arc Gas Light Co., Detroit, Mich..... 890

BURNERS.

C. A. Gefrorer, Phila., Pa..... 891
Wm. M. Crane Co., New York City..... 893
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 891

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 891

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila..... 898
Thos. T. W. Miner, New York City..... 891

PURIFIERS.

R. D. Wood & Co., Phila., Pa..... 906
Stacey Mfg. Co., Cincinnati, O..... 901
The Western Gas Construction Co., Fort Wayne, Ind... 912

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 895

VALVES.

Ludlow Valve Manufacturing Co., Troy, N.Y..... 893
R. D. Wood & Co., Phila., Pa..... 906
Continental Iron Works, Brooklyn, N. Y..... 906
The P. H. & F. M. Roots Co., Connersville, Ind..... 855
Isbell-Porter Co., New York City..... 906
The Western Gas Construction Co., Fort Wayne, Ind.... 912
Kerr Murray Mfg. Co., Fort Wayne, Ind. 904

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind..... 855
Isbell-Porter Company, New York City..... 906
Connelly Iron Sponge and Governor Co., New York City 895
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 904
The Connersville Blower Company, Connersville, Ind... 909

ELECTRICAL APPARATUS.

Wm. Henry White, New York City..... 907

BOILERS, STACKS, TANKS, ETC.

The Hazelton Boiler Company, Rutherford, N. J..... 891

PURIFIER SCREENS.

John Cabot, New York City..... 902

GAS STOVES.

American Meter Co., New York and Philadelphia..... 897
Maryland Meter and Manufacturing Co., Baltimore, Md. 910
Keystone Meter Co., Royersford, Pa..... 910
Nathaniel Tufts Meter Co., Boston Mass..... 910

HOT WATER HEATERS.

The Humphrey Mfg. and Plating Co., Kalamazoo, Mich. 856

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y..... 894

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 905
Continental Iron Works, Brooklyn, N. Y..... 906
Deily & Fowler, Philadelphia, Pa..... 908
Davis & Farnum Mfg. Co., Waltham, Mass..... 904
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 904
Stacey Mfg. Co., Cincinnati, Ohio..... 907
R. D. Wood & Co., Philadelphia, Pa..... 906
Logan Iron Works, Brooklyn, N Y..... 908
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 907

STORAGE TANKS.

Christopher Cunningham, Brooklyn, N. Y..... 892

INVESTORS.

W. R. Faben Construction Company, Toledo, O.. 893

BOOKS, ETC.

Scientific Books..... 892
Newbigging's Handbook..... 910
Gas Flow Computers..... 908
Excerpts from Reports of Gas Commissioners..... 871
Directory of Gas Companies..... 907
Gas Engineer's Laboratory Handbook..... 906
Gas Engineer's Pocket-Book..... 905
Poole on Fuels..... 903
Practical Photometry..... 908
Practical Handbook on Gas Engines..... 901
Hughes' "Gas Works"..... 896
Binders..... 903

GAS BURNERS,

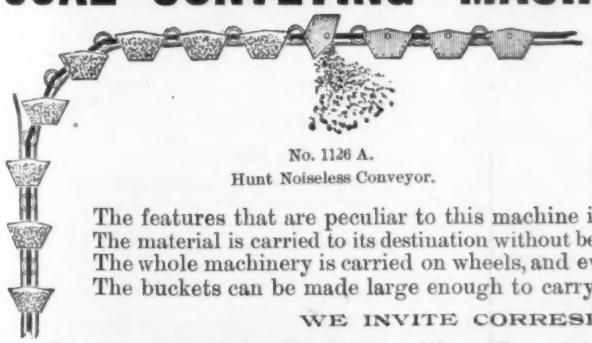
To burn a given amount at a stated pressure, made to order. Samples furnished. Also, small oil and air valves, slow-feed valves for high pressure, and small brasswork in general.

Drip Pumps, Service Cleaners, Gasfitters' Proving Pumps and Mercury Gauges.

C. GEFRORER & SON,

218 North 8th Street, Philadelphia, Pa.

COAL CONVEYING MACHINERY.



No. 1126 A.
Hunt Noiseless Conveyor.

The cost for maintenance, power and labor is far less than any other kind of conveyor.

The machine is noiseless in its operation.

The power required to run the conveyor, in its usual work, is only from 5 to 12-horse power.

The features that are peculiar to this machine in its operation are:
The material is carried to its destination without being disturbed or shaken on the way.
The whole machinery is carried on wheels, and every part is thoroughly lubricated.
The buckets can be made large enough to carry the largest lump bituminous coal.

WE INVITE CORRESPONDENCE.

C. W. HUNT CO., West New Brighton, Staten Island, N. Y.

"THE MINER"

Globe
Street and Boulevard
Lamps.

Cheapest and Best.

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

THOMAS T. W. MINER,

821-823 Eagle Av., N. Y.

Utilize Your Gas Liquor.

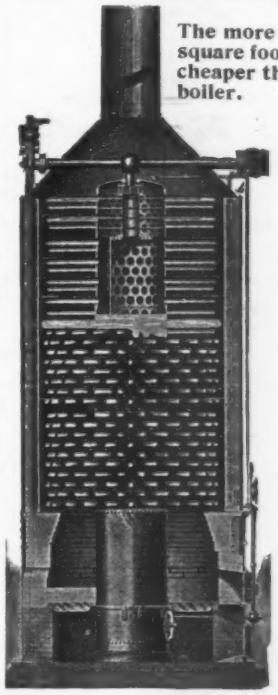
NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to

STROH & OSIUS, Pat'ees, or
Mich. Ammonia Works, Detroit, Mich.

SPACE IS VALUABLE.



The more power secured per square foot of floor space, the cheaper the maintenance of a boiler.

HAZELTON WATER TUBE BOILERS

give more horse power per square foot than any other type in the market. A 250-horse power Hazelton Boiler occupies a floor space but 11 ft. 3 inches square.

CAN YOU BEAT IT?

THE
Hazelton
Boiler
Co.,

RUTHERFORD, N. J.,
U. S. A.

Tele., 6M Rutherford.

Cable Address,
"Paila," Rutherford.

STEWARD { BURNERS, LAVA TIPS, ALAVA Center-Support Cap-Mantles,

Excel in ACCURACY, DURABILITY, CANDLE POWER, FINISH.

The D. M. STEWARD MFG. CO. Works and General Office: Chattanooga, Tenn. New York: 107 Chambers Street.

Newbigging's Handbook for Gas Engineers and Managers.

By THOMAS NEWBIGGING, M. Inst. C. E.

PRICE $6. - For sale by **A. M. GALLENDER & CO., 42 Pine St., New York.**

CHRISTOPHER CUNNINGHAM,

PROPRIETOR,

THE NOVELTY STEAM BOILER WORKS,

BROOKLYN, N. Y.

STORAGE TANKS FOR GAS WORKS,

To Retain Fluid Material of Any Sort.

PIPING IN AND AROUND GAS WORKS.

Work Done for Several of the Largest Gas Companies in America Stands as Reference.

SCIENTIFIC BOOKS.

GAS MANUFACTURE, THE CHEMISTRY OF, by W. J. A. Butterfield. $3.

NEWBIGGING'S HANDBOOK. By Thos. Newbigging. 6th edition. $6.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1900. $5.

HUGHES' GAS WORKS. $1.65.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

HEMPEL'S GAS ANALYSIS, $2.25.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

PRACTICAL HINTS ON REGENERATOR FURNACES. By M. Graham. $1.25.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT; A Manual of Lime and Cement, their Treatment and Use in Construction. By A. H. Heath. $2.50.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp $3.50.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

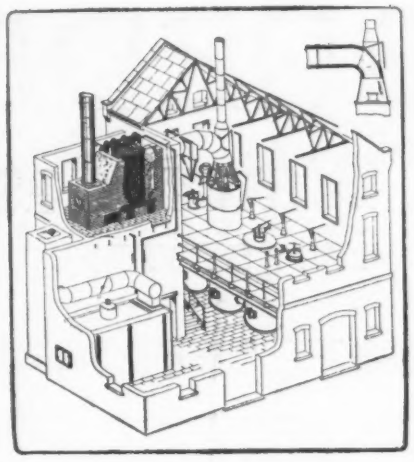
The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 42 Pine Street, New York.

Economize Heat in Water Gas Plants,

BY UTILIZING A

Green's Economizer,



To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

Write for full particulars how this is accomplished, the saving effected, and the advantages gained, to the

GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

Bray Burners

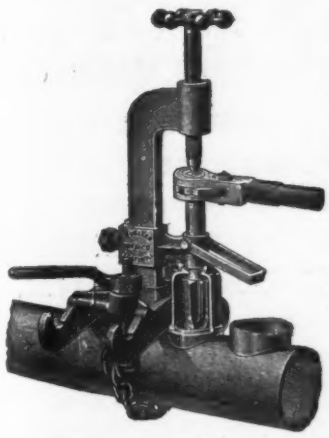
THE STANDARD OF MERIT
THE WORLD OVER.

MADE FOR LOW AND HIGH PRESSURE.
FORTY YEARS' EXPERIENCE.

William M. Crane Co.

1131-1133 Broadway, New York

SOLE AGENTS FOR THE UNITED STATES.



Special Attachment,
B-109.

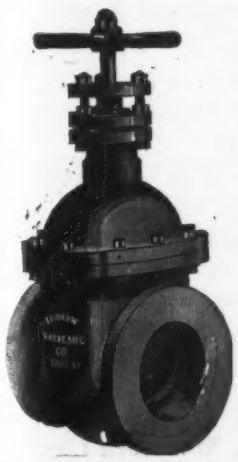
AN INSURANCE POLICY.

TO any manager who is thinking of liability insurance, we would like to show this kind of a machine.

It is a safe machine to work with, your men are safe, and you have a good policy for their protection from asphyxia.

CATALOGUE OF MUELLER MACHINES FROM

H. MUELLER MFG. COMPANY,
DECATUR, ILLS.



THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

THIS IS THE

HUMPHREY GAS ARC LIGHT,

The Best Light in the World

FOR LIGHTING

Stores, Churches, Halls or any large indoor areas.

Guaranteed to give a greater volume of light, better diffused and steadier than an electric arc.

A Complete Revolution in Gas Lighting.

A sample lamp sent on 30 days' trial to any Gas Company.

This lamp is thoroughly protected with both Mechanical and Design Patents. Imitation of this Design and Construction will be prosecuted.

Manufactured by the

General Gas Light Co.,
KALAMAZOO, MICH.

FRED. BREDEL, C.E.

Coal and Water Gas Plants.

OWN SYSTEM.

RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC.

SOLE UNITED STATES AGENT FOR

ARROL-FOULIS MECHANICAL CHARGING AND DRAWING MACHINES.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

GAS RETORTS AND SPECIAL BLOCKS AND FIREBRICK MANUFACTURED UNDER THE SUPERINTENDENCE OF MY OWN CHEMIST.

COMPLETE GAS WORKS

No. 118 Farwell Avenue, · Milwaukee, Wis.

Lloyd Construction Company,

76 HOME BANK BUILDING,

DETROIT, MICH.

MANUFACTURERS AND CONSTRUCTORS OF GAS APPARATUS AND PLANTS.

COAL GAS. Exhausting, Tar Extracting, Condensing, Scrubbing and Washing Apparatus.

WATER GAS. Lowe Double Superheater Apparatus, for all Capacities. Plain and Reverse Steam Connections.

PURIFIERS. Single and Double Depth, Center Seals or Valve Connections, Travelling Carriages, Oxide Conveyors.

Flanged and Street Specials, Gas Valves, Roofs, Iron Floors, etc., etc.

Complete Plants Erected.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,

238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND,

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

Coal Tar Genealogical Tree.

MR. T. VINER CLARKE, of London, England, having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

In the form of a Genealogical Tree, including all the products discovered to date, the total number amounting to near 700, offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, 3.50. Orders may be sent to

A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

The Advertisement of the

P. H. & F. M. ROOTS CO., Mfrs. of Gas Exhausters, Blowers, etc.,

Connersville, Ind., - - - - 109 Liberty Street, New York City,

Occupies this Space Every Alternate Week.

Connelly Iron Sponge and Governor Co.,

395 Broadway, New York City.

TELEPHONE, 3033 Franklin. - - - CABLE ADDRESS, Governorco.

GEO. G. RAMSDELL, General Manager. S. F. HAYWARD, Treasurer.

MANUFACTURERS OF

CONNELLY

Automatic and Balance Governors,

Iron Sponge.

EASTERN AGENTS

P. H. & F. M. ROOTS CO.,

Exhausters and Exhauster Governors.

AGENTS FOR THE UNITED STATES,

JONAS DRAKE & SON

SYSTEM OF

Inclined Retorts.

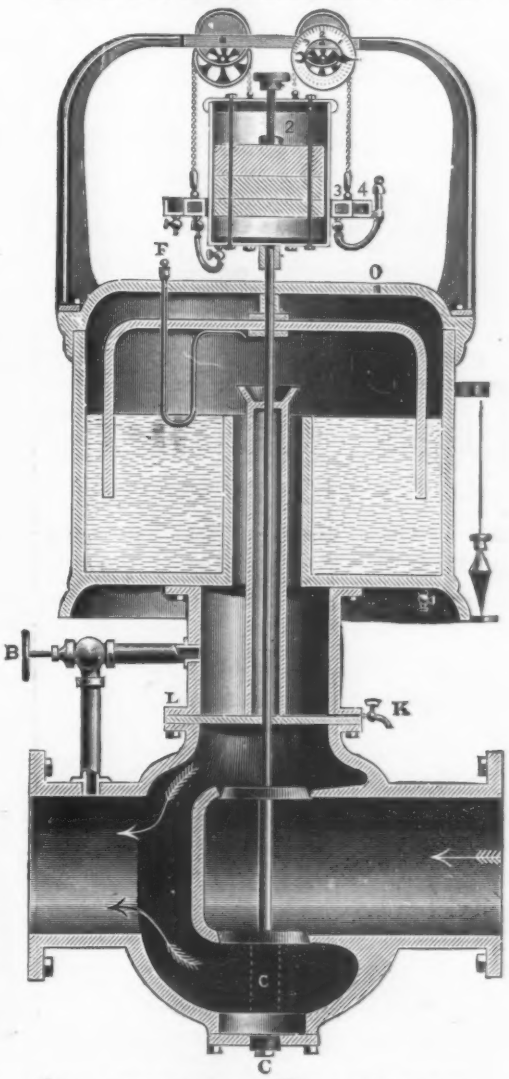
ZIMMER SWINGING CONVEYORS,

FOR HANDLING COAL OR COKE.

Jones Jet Photometer.

GAS SPECIALTIES.

CONNELLY'S



AUTOMATIC GOVERNOR.

MODEL OF 1900.

CONSTRUCTORS OF COAL GAS APPARATUS.

"Globe Specials, Valves, Etc." "Glamorgan" Pig Hydrants

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON FLANGE GAS AND WATER PIPE

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

CAST IRON GAS & WATER PIPE

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light, DAYTON, O.

Hughes' "GAS WORKS,"

Their Construction and Arrangement,

And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.
Rewritten and Much Enlarged by

WM. RICHARDS, C.E.

Eighth Edition, Revised, with Notices of Recent Improvements.

Price, $1.65.

A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.

THE

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

SECOND EDITION.

THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

Price $2. For Sale by

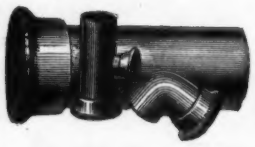
A. M. CALLENDER & CO.,

42 Pine Street, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.



CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

CHARLES MILLAR & SON CO., Selling Agents, Utica, N.Y.

Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

UTICA PIPE FOUNDRY CO.

Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.

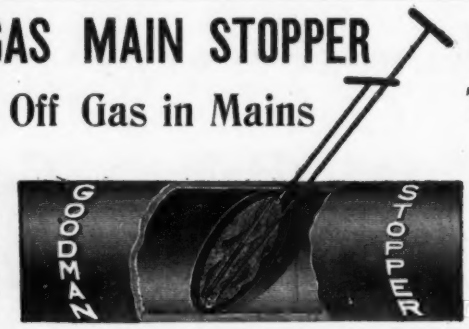
CAST IRON PIPE and SPECIALS FOR WATER AND GAS.

Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :



Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

MOST GAS COMPANIES DO SELL, ~ ~ EVERY GAS COMPANY SHOULD SELL

Humphrey Crescent Instantaneous Water Heaters,

A LUXURY and NECESSITY.

This is Our No. 2 Heater.

Supplies hot water for domestic use as well as for the bath. It Has No Equal

LIST PRICE NICKEL PLATED, $35.00,

including nickel plated shelf and brackets.

We have many styles, which range in price from our No. 10, at $45.00, to our No. 8, at only $20.00.

Every Heater Guaranteed.

SEND FOR CATALOGUE AND PRICES.

Will send heater on 60 days' trial to any Gas Company.

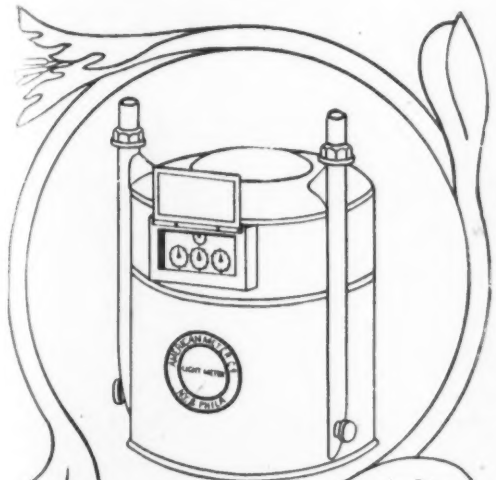
The Humphrey Manufacturing and Plating Company, KALAMAZOO, MICH., U.S.A.

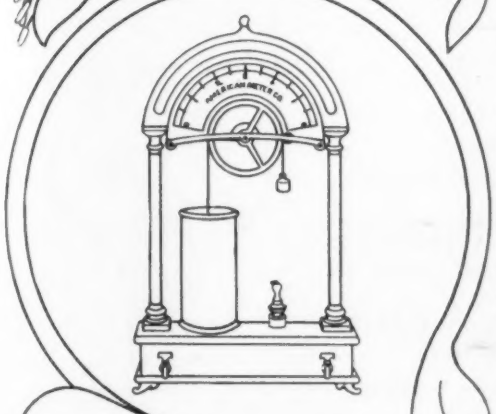
THE GAS ENGINEERS' POCKET-BOOK, By Henry O'Connor.

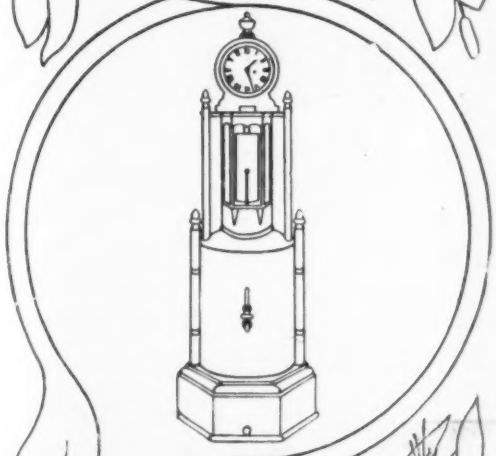
Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. PRICE, $3.50.

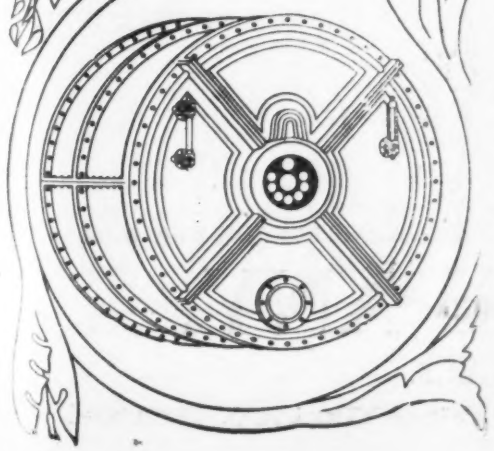
—FOR SALE BY—

A. M. CALLENDER & CO., 42 Pine Street, New York City.









(Copyrighted, 1894, by the AMERICAN METER CO.)

AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1862.

NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.

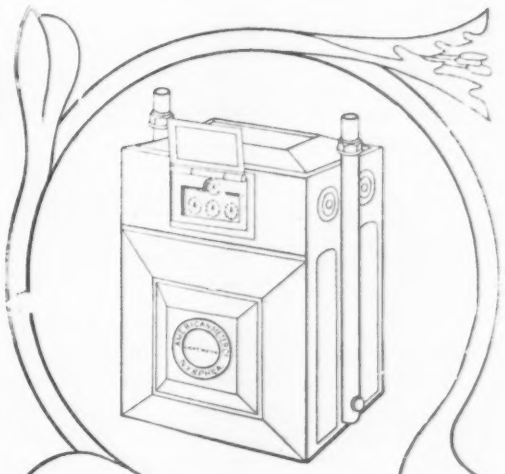
PUBLIC LIGHTING TABLE.

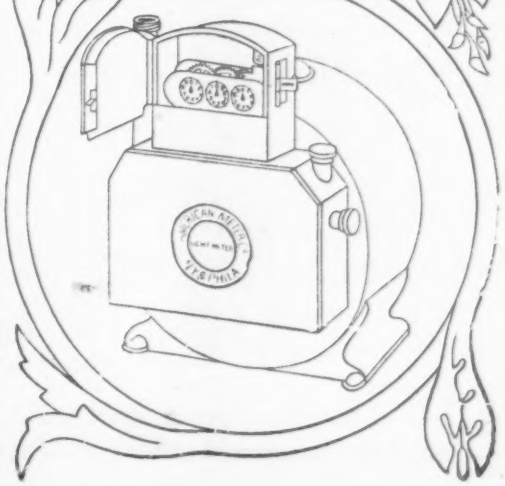
JULY, 1902.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	8.00 PM	2.50 AM	7.30	3.15
Wed.	2	8.00	3.40	7.30	3.15
Thu.	3	8.00	3.40	7.30	3.15
Fri.	4	8.00	3.40	7.30	3.15
Sat.	5	8.00 NM	3.40	7.30	3.15
Sun.	6	8.00	3.40	7.30	3.15
Mon.	7	8.00	3.40	7.30	3.15
Tue.	8	8.00	3.40	7.30	3.15
Wed.	9	8.00	3.40	7.30	3.15
Thu.	10	9.40	3.40	7.30	3.15
Fri.	11	10.10	3.40	7.30	3.15
Sat.	12	10.40 FQ	3.40	7.30	3.15
Sun.	13	11.20	3.40	7.30	3.15
Mon.	14	11.50	3.40	7.30	3.15
Tue.	15	12.30 AM	3.40	7.30	3.15
Wed.	16	1.20	3.40	7.20	3.15
Thu.	17	2.00	3.40	7.20	3.15
Fri.	18	3.00	3.40	7.20	3.15
Sat.	19	No L.	No L.	7.20	3.15
Sun.	20	No L. FM	No L.	7.20	3.15
Mon.	21	No L.	No L.	7.20	3.15
Tue.	22	7.50 PM	9.20 PM	7.20	3.15
Wed.	23	7.50	9.50	7.20	3.15
Thu.	24	7.50	10.20	7.20	3.15
Fri.	25	7.50	10.50	7.20	3.15
Sat.	26	7.50	11.20	7.20	3.15
Sun.	27	7.50 LQ	12.00	7.20	3.15
Mon.	28	7.50	12.40 AM	7.20	3.15
Tue.	29	7.50	1.30	7.20	3.15
Wed.	30	7.50	2.30	7.10	3.30
Thu.	31	7.50	4.00	7.10	3.30

TOTAL HOURS LIGHTING DURING 1902.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	238.30	January	423.20
February	196.20	February	355.25
March	196.20	March	355.35
April	166.40	April	298.50
May	151.40	May	264.50
June	131.10	June	234.25
July	142.40	July	243.45
August	162.00	August	280.25
September	179.00	September	321.15
October	216.30	October	374.30
November	224.10	November	401.40
December	250.00	December	433.45
Total, yr.	2255.00	Total, yr.	3987.45

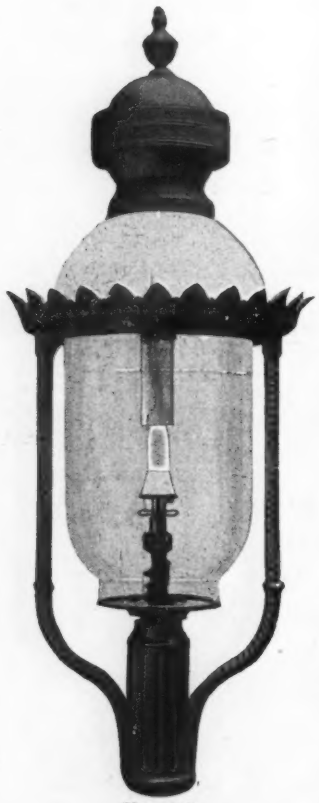




NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others Interested in Municipal and Outside Lighting.

No. 38.

UNIVERSAL WELSBACH BURNER.

The most practical, efficient and artistic burner yet produced. . . . . .

It contains an improved adjustable Bunsen so constructed as to permit of a wide range of variations in gas pressure without blackening the mantles and without an adjustable air shutter. . .

It can be used with all styles and sizes of glassware, either shades or globes. No further necessity to carry a stock of different burners for the many sizes and shapes of glassware.

GAS COMPANIES AND DEALERS CANNOT FAIL TO APPRECIATE THE MANY SALABLE FEATURES OF THIS NEW BURNER.

WELSBACH COMPANY,

GLOUCESTER, N. J. CHICAGO, ILLS.

Salesrooms in all the Leading Cities of the United States.

THE STANDARD DOUBLE SUPERHEATER

LOWE WATER GAS APPARATUS.

The capacity of apparatus installed, if operated continuously, is sufficient to make more than the entire amount of artificial gas annually sold in the United States.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

A. H. GUTKES, President. E. L. RICE, Vice-President. H. A. PERKINS, Secretary.

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St., Brooklyn, N. Y.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office: 914, 915 & 916 Wainwright Building, St. Louis, Mo.

New Edition in Press. Soon to be Issued.

PRACTICAL HINTS ON THE

Construction and Working

—) OF (—

Regenerator Furnaces,

—) BY (—

MAURICE GRAHAM,
M. INST. C.E.

Price, $1.25. For Sale by
A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

Adam Weber Sons.

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Main Offices, Park Row Bldg., New York.

Modern Recuperative Furnaces.

Standard Fire Brick and Gas Retorts.

Designers and Builders of Chimneys of Perforated ..Radial Blocks..

ISAAC C. BAXTER, President.

Works,
LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON,

PETER YOUNG, Sec'y and Treas.

Address all communications to
JAMES GARDNER, JR., CO., Box 277
JOHNSTOWN, PA.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. Galesburg, Ills., or Buffalo, N. Y.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,
417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

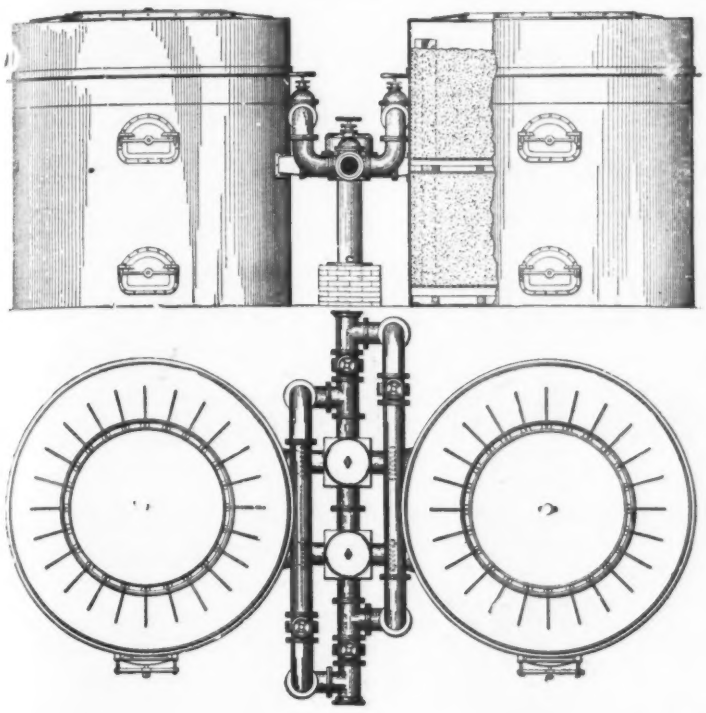
—MANUFACTURERS OF—

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office: *411 Olive Street, Continental Bank,* ST. LOUIS, MO.



Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

Patented in UNITED STATES, CANADA, GREAT BRITAIN, FRANCE, BELGIUM, GERMANY, AUSTRIA AND HUNGARY.

NOTICE TO GAS COMPANIES!

The unauthorized use of any system or method of purification, whereby gas mingled with oxygen is made to flow in one general direction through the purifying mass, and then made to flow through the mass in a directly opposite direction, infringes the above patents!

For Estimates Write

The Stacey Mfg. Co.,

SOLE MANUFACTURERS,

CINCINNATI, O.

Newbigging's Handbook for Gas Engineers and Managers,

By THOMAS NEWBIGGING, M.Inst.C.E.

Price, $6. For Sale by

A. M. CALLENDER & CO.,
42 Pine St, N. Y. City.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Engineers and Builders of water and coal gas apparatuses and general gas works machinery. : : :

AMERICAN OFFICES:

269 Front Street, East Toronto, Ont.

LONDON OFFICES:

19 Abingdon St., Westminster, S. W.

CABLE ADDRESS:

"CARBURETED" LONDON AND TORONTO.

Parson's Steam Blower

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR USING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 457 Putnam Ave., Brooklyn, N. Y.

PRACTICAL HANDBOOK ON

GAS ENGINES,

With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the Author, by GEO. M. RICHMOND, M.E.

PRICE, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

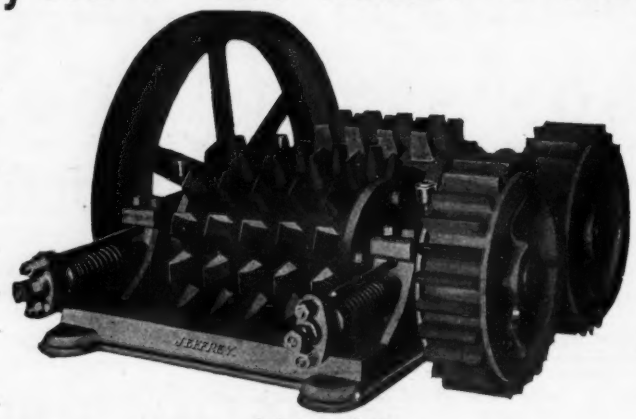
PURIFIER **TRAYS** SCRUBBER

John Cabot,
553-557 W. 33d St., New York.

Bristol's Recording
PRESSURE GAUGE.
For continuous records of
Street Gas Pressure.
Simple in construction, accurate in operation and low in price.
Fully Guaranteed. Send for Circulars.
THE BRISTOL CO.,
Waterbury, Conn.
Silver Medal, Paris Exposition.

Jeffrey Coal and Coke Crushers and Elevators.

Screens.
Chains.
Wheels.
Dump Cars.
Send for Catalogue.

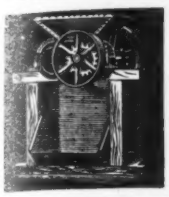


Jeffrey Crushers.

Elevator Buckets.
Rubber Belt Conveyors.
Chain Conveyors.
Our Prices will Interest you.

ADDRESS,
THE JEFFREY MANUFACTURING CO.,
COLUMBUS, OHIO, U. S. A.
New York, Chicago, Denver, Buffalo, Philadelphia, Butte, Mont., Kansas City, St. Louis.

The Gas Engineer's Laboratory Handbook,
By JOHN HORNBY, F.I.C. Price, $2.50.
Orders may be sent to
A. M. CALLENDER & CO., 42 Pine St., N. Y.



KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50. For sale by

A. M. Callender & Co., 42 Pine St., N. Y.

POOLE ON FUELS.

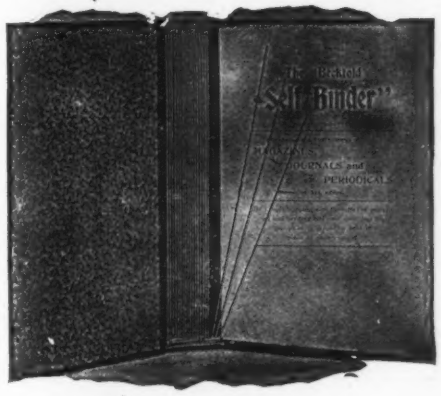
THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY.

BINDER for the JOURNAL.



Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

EDMUND H. McCULLOUGH, President. CHAS. F. GODSHALL, Treasurer. H. C. ADAMS, Secretary. HENRY WHARTON, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE LINK-BELT MACHINERY CO.,

ENGINEERS, FOUNDERS, MACHINISTS,
Chicago, U. S. A.

"Link-Belt" Breaker.

Tilting Coal and Coke Cars, Breaker Rolls, Power Transmitting Machinery.

LINK-BELT ELEVATING & CONVEYING MACHINERY for HANDLING COAL, COKE, OXIDE, ETC.

Machinery designed and erected to suit existing conditions and available space.

CATALOGUE UPON APPLICATION

PHILADELPHIA, LINK-BELT ENGINEERING CO.

THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Coal Tar Genealogical Tree

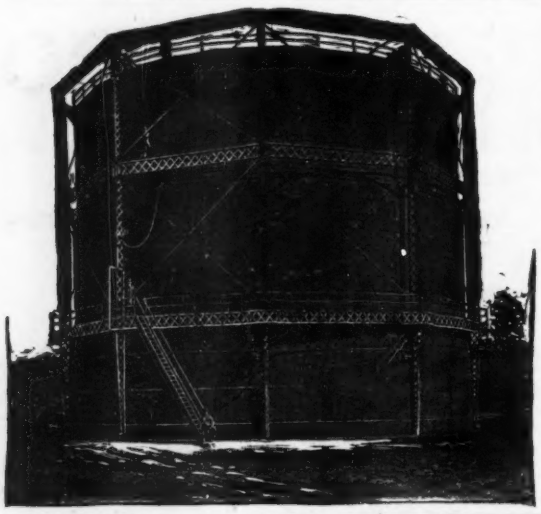
MR. T. VINER CLARKE, of London, Eng.,

Having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR.

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,

Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

BREVARD, N. C.

JAMES T. LYNN,

GAS ENGINEER AND CONTRACTOR,

Wayne Bank Building, - DETROIT

GAS PROPERTIES PURCHASED.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,

Consulting Engineer AND CONTRACTOR,

PARK ROW BUILDING, N. Y.

KERR MURRAY MANUFACTURING CO.

Latest Design Rotary Exhauster, With Automatic Governor,

Single or Double-Lift Gasholders,

WITH OR WITHOUT STEEL TANKS.

Storage Oil Tanks, Condensers and Scrubbers.

Purifying Boxes, with Cover-Lifting Apparatus, Center Seal or Valve System Connections and Oxide Elevator.

REVERSIBLE WOOD PURIFYING AND SCRUBBING TRAYS.

Mouthpieces, Standpipes, Etc.; in Fact, All Classes of Ironwork for Benches.

DOUBLE GATE ALL IRON GAS VALVES, 3 TO 36 INCHES DIAMETER.

ALL SIZES OF STREET SPECIAL CASTINGS.

FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double and Single-Lift Gasholders.

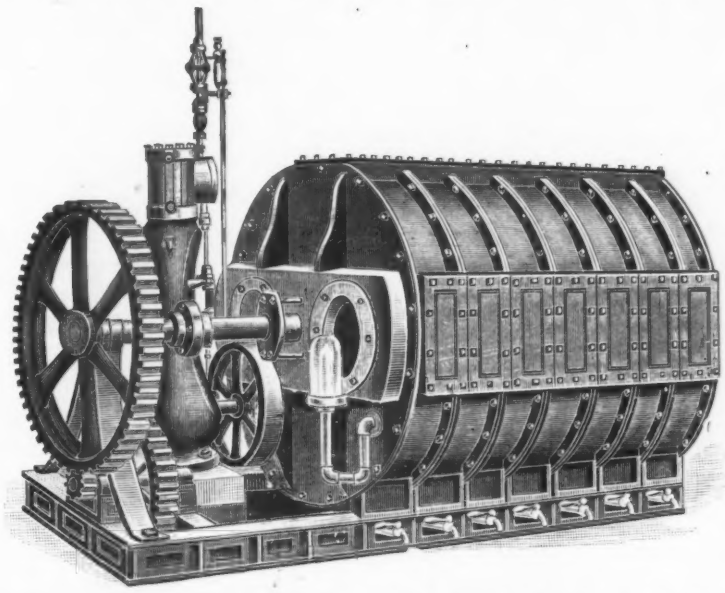
Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS

PURIFIERS.



CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS.

Boilers.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

A. M. CALLENDER & CO. 42 Pine Street, New York City.

ALEX. C. HUMPHREYS, M.E., M. Inst. C.E. ARTHUR G. GLASGOW, M.E., M. Inst. C.E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London S.W., England.

CONSULTING GAS AND ELECTRIC LIGHT ENGINEERS.

PROPERTIES PURCHASED.

COMPLETE EXAMINATIONS MADE.

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA.

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single, Double and Triple Lifts, with or without Metal Tanks

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

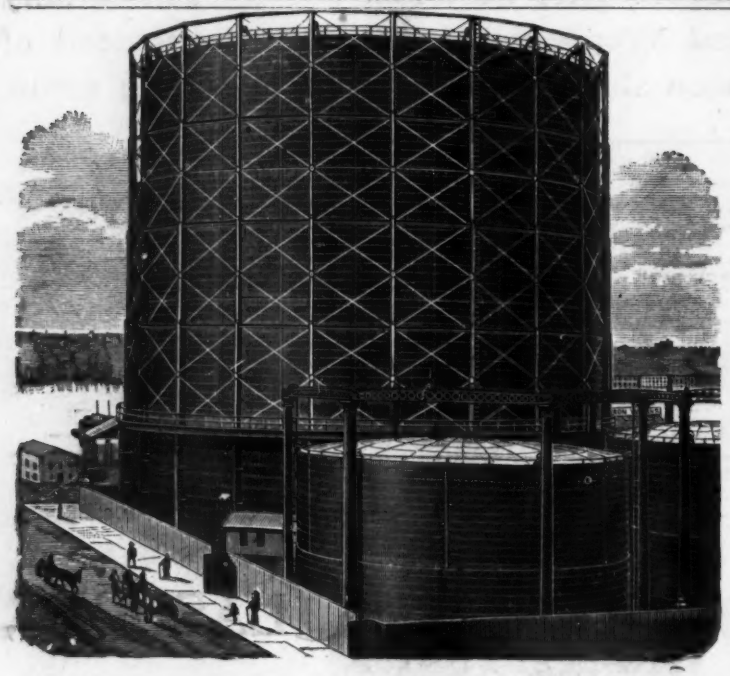
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. OFFICES **Bridge & Ogden Sts., Newark, N. J.**



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cuttlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $3.50.

A. M. CALLENDER & CO., 42 Pine St., N. Y. City.

THE STACEY MANUFACTURING CO.,

CONTRACTORS FOR THE ERECTION OF COMPLETE WORKS.

GAS WORKS APPARATUS.

GASHOLDERS

WITH AND WITHOUT

STEEL TANKS.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT AND CAST IRON WORK.

OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

PLANS, SPECIFICATIONS AND ESTIMATES CHEERFULLY FURNISHED.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

No. 62 Wall Street, - - - New York City,

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

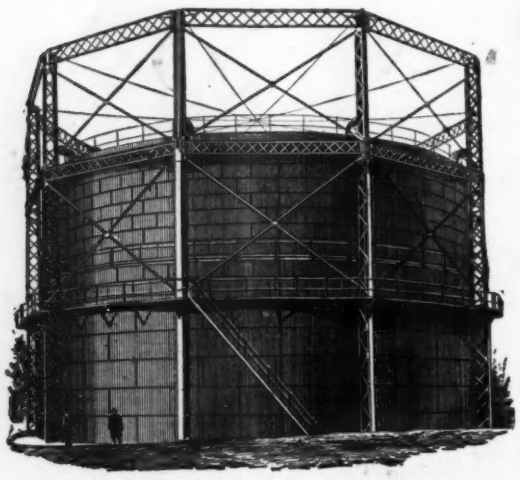
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

1902 DIRECTORY 1902

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



1842 ※ Deily & Fowler, ※ 1902

LAUREL IRON WORKS.

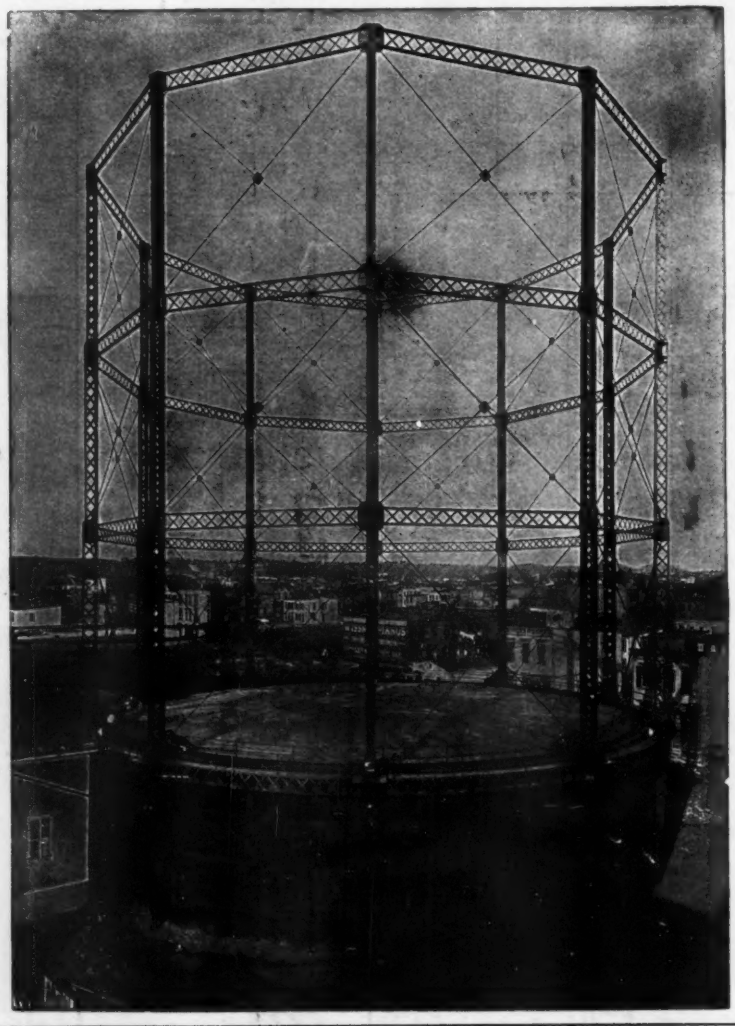
Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu. Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

Self-Sealing Retort Lids,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for Complete Works.

ALSO, SOLE MANUFACTURERS OF

C. W. BLODGET'S

HOT GAS SCRUBBER.

PRACTICAL PHOTOMETRY,

A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 70,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

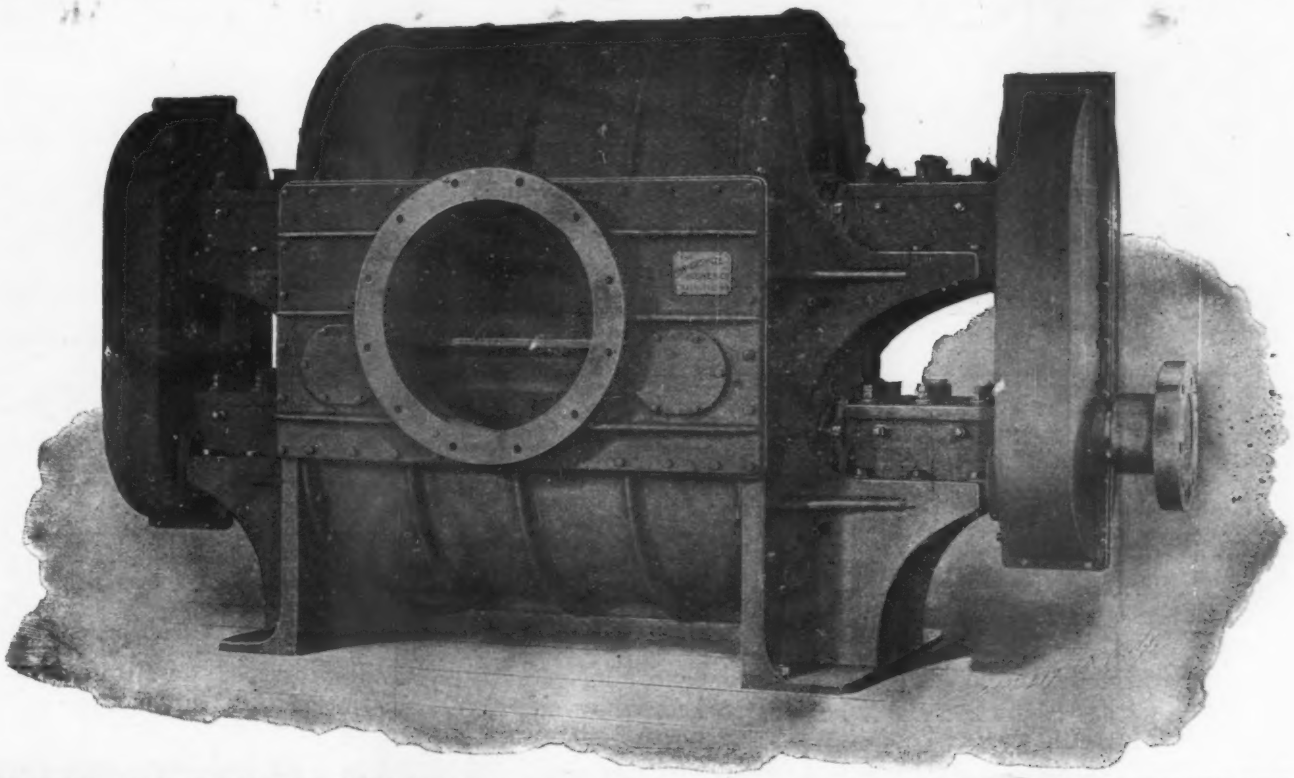
Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | 34 & 36 West Monroe Street, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

Established 1849. With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS METER CO.,

8 Medford Street, Boston, Mass.

MANUFACTURERS OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Prepayment Gas Meters.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. CHICAGO, 88 to 92 Jackson Boulevard.

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

THE KEYSTONE PREPAYMENT

IS

An Accurate Registrar,
A Sure Shut-off,
An Ideal for Easy Adjustment,
A Model of Simplicity,
A Paragon of Excellence, and
A Mighty Good All-round Meter.

Get Acquainted with it.

Keystone Meter Co., ROYERSFORD, PA.

WIESTER & CO., 22 Second Street, San Francisco, Cal.

NOW READY.

THE SIXTH (AND CENTENARY) EDITION

— OF THE —

Handbook for Gas Engineers and Managers.

By THOMAS NEWBIGGING, M. Inst. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, - - $6.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, N. Y. City.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, SAN FRANCISCO.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

This is the best time to look after your repairing.

Seventy per cent. of old meters run slow. You are losing money on them. Let us put them in shape for you, a few at a time, until your entire meter equipment is made as good as new. It is better to attend to this matter now, before the Gas Stove season is at its height. Probably we can do such work in our factory better and cheaper than you can do it at home, and just now we can do it promptly.

The BUHL METERS are as good Meters as you can get.

DETROIT METER COMPANY, = = Detroit, Mich.

Advertisement of

JOHN J. GRIFFIN & CO., Mfrs. of Gas Meters, etc.,

Nos. 1513, 1515, 1517, 1519 & 1521 Race Street, Philadelphia,

559 West 47th Street, New York, 34 West Monroe Street, Chicago,

Occupies this Space Every Alternate Week.

THE WESTERN GAS CONSTRUCTION COMPANY,

Gas Engineers & Builders.

IMPROVED LOWE WATER GAS APPARATUS.

IMPROVED COAL GAS APPARATUS.

Contractors for the Construction of Complete New Works and the Reconstruction of Old to Increased Capacity and Efficiency. Special Apparatus, Valves and Fittings.

Fort Wayne, Indiana.